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Scientific and Industrial Research in Great Britain

WITH the increase in the number of reports issued by individual boards or departments under the Department of Scientific and Industrial Research, the value of the Department's own report, a survey of which appears on p. 499 of this issue, and especially that of the Advisory Council, is enhanced rather than diminished. Apart altogether from the broad picture it gives of the many-sided contributions made by the Department to the welfare of the whole nation, it has become increasingly a vehicle for the discussion of the more fundamental problems of co-operative scientific and industrial research, and of the factors upon which success or failure in this field depend.

An important section of the report of the Advisory Council is this year devoted to the position of the research associations, and this discussion is of the greater interest in view of the recently published report of the Parliamentary Science Committee on the Finance of Research (referred to in NATURE of January 28). Indeed it may be said that, taken as a whole, the report of the Department supplies a much more convincing answer to the arguments of that report than those in the observations of the Advisory Council on, and published with, that report. The practice of the Department is even more reassuring than the arguments advanced by the Advisory Council in defence of the policy upon which that practice is based. The straightforward narrative of the achievements of the Department contains encouraging evidence of flexibility and foresight, and some attempt to diminish those fluctuations of income which have such an adverse effect alike upon the conduct of long-range investigations and on the work of the staff responsible for their conduct.

Five years ago, the major part of the report of the Advisory Council was devoted to a historical review of the research association scheme for developing the application of science by industry in Great Britain, and its criticism of the movement was directed to the inadequate scale on which it was financed. Recommendations then made for remedying this weakness were accepted by the Government, but subsequent discussions with the various associations led the Advisory Council to believe that to encourage them to embark on operations on a more adequate scale the basis on which grants were made must be definitely shaped with that primary purpose. Accordingly the Council recommended that the Department offer block grants of so substantial an amount that, with the contributions from industry upon which they should be conditional, they would secure an income adequate for each association to develop a really effective organization. To encourage further development, the Council recommended additional grants, on a sliding scale, within prescribed limits, on all income raised from industry in excess of a specified figure. The amounts of the minimum income, the specified figure and the limit of the grant were to be determined on the merits and needs of each case, and the normal period of these new arrangements was to be five years. The success of this plan is shown by an increase of nearly forty per cent in the total sum subscribed annually by industry on the amount provided before it came into operation, although it has to be admitted that that sum is still only a little more than a quarter of a million pounds.

The Advisory Council has now again reviewed the whole position, and arrangements have been made by which consideration of individual research associations will be spread over several years, thus keeping the general scheme under inspection and securing a thorough periodical examination

of each individual association. It is proposed to make a detailed review of the work and progress of each association at the end of the particular five-year period for which its grant has been made, before recommending grants for a further period.

This arrangement has brought under review in the present report the Wool Industries Research Association and the research association of the iron and steel industry. Grants have also been made to the newly formed British Coal Utilisation Research Association. The comments in the report of the position of these and other associations deserve some note as indicating some of the general tendencies and weaknesses of the research association movement.

It will be remembered that in observations on the memorandum of the Parliamentary Science Committee on the Finance and Development of Research, the Advisory Council reiterated the view which was expressed in its report for 1930–31 that the expenditure on research which is defensible in the national interest depends on the degree to which industry generally is prepared to apply scientific method and advances in scientific knowledge. The position of the Wool Industries Research Association illustrates the limitations and defects of that method. The admirable work already conducted at Torridon, with the light which it has thrown, for example, on the fundamental structure of animal fibres, has earned for the Association a high scientific reputation, and the fundamental knowledge and technique thus acquired have found application in fields well beyond the bounds of the woollen industry. It cannot accordingly be regarded as entirely satisfactory that such important contributions to the general body of scientific knowledge should be retarded by the failure of an industry to appreciate the importance of research.

It is, of course, realized that only an industry that is thoroughly research-minded can be expected to support such fundamental research, the bearing of which upon manufacturing technique or development is not immediately apparent. If, however, there is any force in the contention that fundamental or long-range research is pre-eminently the field of the research association, as distinct from the research departments of individual forms, the present policy of the Advisory Council has obvious limitations and design. That this is realized by the Advisory Council is indeed shown by its own recommendations in regard to the British Boot, Shoe and Allied Trades Research Association. Failure of this Association to obtain and maintain an industrial income of only £7,000, which would have secured a total income of £12,000, led to it operating for two years without a grant. Impressed by the special limitations in the field of work open to this Association, owing to the almost complete monopoly in the supply of machinery to the industry, and in view of the importance of shoe-efficiency to the national health, the Advisory Council as an exceptional measure has recommended an offer of renewed grant aid which will secure for the Association a minimum income of £8,000 a year with a possibility of £12,000.

In a recent letter (NATURE, **143**, 336; Feb. 28, 1939), Dr. W. H. Gibson stressed the importance of consideration of the position of research associations in a scientific spirit, and directed attention to some of the limitations which are commonly imposed on their work. If they are to confine themselves to research on the processes of their members, they will be limited in their work essentially to those fields which are the natural territory of the research departments of the individual firms. This means further limitation of the fundamental research which is the basis of all major industrial advance, but which is often beyond the resources of all but the very largest of industrial units, and indeed it may be added, is often a tax upon the resources of the best-equipped university departments, to which alone we can look further for assistance. It may be noted that the large industrial firms often prefer to support such investigations by specific grants to a university department rather than to embark on them in their own laboratories.

Even, however, if we could safely rely on the universities for the fundamental research which is required for the advance of industry—and there are very definite limits to the extent to which research at a university should be dictated even by national needs, let alone the requirements of industry—it is obviously unreasonable, if not impossible, to expect them to provide for a further need to which Dr. Gibson directed attention. Dr. Gibson stressed the importance of research upon the raw materials themselves, the price of which often constitutes a large proportion of the price of the finished article. Unless and until attention is paid to ensuring ample supplies of uniform quality and reasonable price, no amount of research on processes will overcome the difficulties of British industry.

Equally important is research in developing entirely new uses for raw materials outside existing

channels. Many notable advances have originated from the use of some raw material for a new purpose. Under present conditions, a research association which is working for members who are operating established processes cannot embark on such investigations. Accordingly a most fruitful field lies neglected and unfinanced.

As we have repeatedly urged in these columns, what is required is a scientific approach to the whole problem, and the orientation and distribution of the national research effort in accordance with a comprehensive survey of the resources available. This is essential, apart altogether from the question of the magnitude of the total effort or even of the relative contribution of industrial or national sources. Only as we can assess with some degree of accuracy the contribution which is being made in different fields and from different sources can we make any sound decision as to the magnitude of the contribution which should come from the national revenue. The observations of the Advisory Council on the position of the research associations emphasize the need for this comprehensive survey and for some attempt to delineate broadly the field between the various research organizations—private enterprise, research associations, Government research stations and the universities.

An authoritative survey of this type could scarcely be undertaken except under Government initiative and authority, although it is possible that something on these lines might come within the field of the newly formed Division for the Social and International Relations of Science of the British Association. At least it might facilitate the scientific approach to the problem which is badly needed, and the enunciation of principles upon which increased Government grants for scientific research could be indubitably justified, whether to the universities themselves, to Government research stations or institutions or to the research associations.

A step of this kind should not be without effect on a further aspect of the situation to which Dr. Gibson also directed attention—the position of the scientific worker. The great divergencies which exist between the position of scientific workers engaged in essentially similar duties in the universities, Government establishments, private firms and research associations are not to be defended. Co-operative research associations which are supported in part by an industry are at a disadvantage in retaining an experienced staff as compared with an industry which for some reason or other may make no contribution towards co-operative research, either getting it done by a Government establishment or relying on individual and private effort. The results achieved in co-operative research depend not merely on the financial resources at the disposal of the research associations but also on the calibre of their scientific and technical staff. If the conditions of service are so inferior in remuneration or security to those which obtain elsewhere that they cannot compete on equal terms with private industry or Government departments in recruiting their staff, the quality of their work must ultimately be lowered.

The importance of this question to the industries concerned, no less than to the nation itself, need scarcely be stressed in view of the past achievements of the research association movement. It deserves closer attention than it has yet received from the professional associations of scientific workers, and any comprehensive survey and analysis of the research effort of the nation should have reference to this problem also. It should not be forgotten, of course, that mobility of staff within limits has its own advantages in stimulating the exchange of technique and ideas. A definite drawback of pension schemes is in fact the indirect discouragement which they give to the movement of staff, and there are other factors which in recent years have discouraged the movement of scientific workers from one firm to another, whether within the same industry or not. Such movement may be stimulating in ideas and technique as well as facilitating the growth of a wider judgment or experience of great value in the direction of research in industry and Government service.

A more liberal policy in regard to the exchange of pension rights might well prove a sound investment both to Government services and industry, and it should not prove beyond the national resources to devise some means of eliminating that factor of insecurity of tenure which in other fields of research besides that of the research associations tends to affect adversely the recruitment of scientific staff of the highest quality. Certain it is that if the research association movement is to find a definite place in the national organization for research, it will only make its full contribution if the same careful consideration is given to the broad fields in which it should operate, and to the conditions of recruitment and employment of its scientific and technical staff, as has been given in the past to the assessment of its financial grants.

Vitamin B_1 and Scientific Endeavour

Vitamin B_1 (Thiamin) and its Use in Medicine By Dr. Robert R. Williams and Prof. Tom D. Spies. (Macmillan Medical Monographs.) Pp. xvi + . (New York: The Macmillan Co., 1938.) 21*s.* net.

"IT is doubtful whether the isolation and identification of any other substance in the history of biochemistry have cost as much labor as have these operations as applied to thiamin. The first gram of the pure vitamin must have cost an aggregate of several hundred thousand dollars. To mention all the names of those who have participated in some phase of the project is to call the roll of half the mature biochemists in England and the United States. The project has bulked equally largely upon the horizon of Dutch, Japanese and French Biochemistry. German participation has been relatively small until the current decade."

"ONE could be pardoned for hoping that a knowledge of the chemical structure of thiamin would promptly suggest the mode of its action and resolve many of the problems that have plagued us for a generation. The natural processes into which it enters are, however, so complicated that for the present at least this knowledge only opens up a vista of new problems. The progress of the past year has been such as to justify the optimism for the future, but the gratification of our most sanguine hopes must be deferred for a time."

VITAMIN B_1 is now the most important of a group of vitamins constituting the original vitamin B. These opening paragraphs to two of the chapters in this book indicate the magnitude of research effort in connexion with this one chemical substance, as well as the task set themselves by the authors; to this must be added that they have tried to make available the present knowledge in practical medicine. Of this value there is at the present time no doubt; as well as a complete cure of the disease of beriberi, we know that in neuritis of various origins (especially alcoholic) and other conditions, there may be involved a factor of vitamin B_1 deficiency. Even in pellagra, in which the mouth and skin symptoms are now known to be cured by nicotinic acid, nervous symptoms are found to respond to vitamin B_1. The pyrophosphoric ester of this vitamin, the so-called co-carboxylase, is essential in the production of the precursor of alcohol (acetaldehyde) in alcoholic fermentation from pyruvic acid. There is an element of romance which defeats the scientific approach when we realize that this very vitamin, which is responsible for the production of the alcohol in wines and spirits, must be administered to protect the subject from the neuritis due to excessive indulgence in the alcohol so produced! In the nervous system as elsewhere, vitamin B_1 is required for the degradation of pyruvic acid, which forms an essential stage in metabolism of carbohydrate and may be concerned in one intermediary stage in the formation of fat.

The tale which is told by the authors is viewed in the first instance as a problem in practical medicine and in the construction of diets which may be needed to save from the consequences of vitamin B_1 deficiency even in its milder forms; the conclusions here reached indicate that 1–2 mgm. of the vitamin are needed per diem to ensure health, and should do much to displace a facile optimism that the eating of an ordinary mixed diet is enough to ensure health. A particularly valuable feature of the work is the inclusion of the tables of the vitamin B_1 content of foods; these will form a basis for future research. This section of the work, in which Dr. Williams has had the advantage of Dr. Spies's present practical experience of nutritional deficiency, should be read by all those who are responsible for the maintenance of the health of the community, as well as being a guide in practical medicine.

The more medical part forms eight out of the twenty-nine chapters, the latter two-thirds of the book being devoted to the chemical nature and mode of action (biochemical and physiological) of this vitamin. In the final efforts to reach the constitution and synthesis, there is no doubt that Dr. Williams's discovery of the cleavage produced by sulphite was one of the major factors in chemical advance. Nevertheless it is interesting to reflect that there was a happy fitness in his successes; Dr. Williams's work started in 1912, and the final synthesis of the pyrimidine-thiazole compound by several people independently only took place some eleven years after the first isolation of practically pure crystals by Jansen and Donath. This was because the problem had not become one in pure organic chemistry until shortly before the end, even in spite of the international co-operation mentioned in the initial paragraph. Labels may be said to be rapidly disappearing in science as the boundaries of discipline become more fluid, but no group of workers can feel particularly conceited when the finish of their own work still leaves untouched so many essential problems. It has been seen that one prominent function of the vitamin (or of its esters) is decarboxylation. For the true insight into the mechanism by which this is effected we

may have to wait until a deeper knowledge of the structure of the atom is available; it is certain that the organic chemical structure does not enable us to predict the reason why the molecule (as the diphospho-ester) decarboxylates in yeast, but in higher organisms requires a simultaneous oxidative process.

The tale of the various functions of thiamin in Nature, its need for the growth of micro-organisms, and of the work which has led to the present idea of the intimate connexion with carbohydrate metabolism is well told, with due caution and criticism and not without pointers for the future. It is a safe generalization, to which there is not much exception, that wherever there is life some form of this vitamin is a necessity. To this extent the original idea implied by Funk in the term 'vitamin' is now justified. Upon nomenclature there is still some controversy, perhaps not very important. To many it will be difficult to dissociate their minds from the term 'vitamin B_1'. Others think with justification that the name 'aneurin' should be used as it was proposed by Jansen, the first to isolate crystals of the vitamin. Dr. Williams adheres throughout to the sombre 'thiamin', used by the American Medical Association.

The reviewer has nothing but praise for this work as a whole, for the knowledge which it displays, for its fair judicial outlook, and for its production. He has not detected many errors. One might be mentioned: the work of Carter and Drury, mentioned on p. 211, actually preceded that of Drury, Harris and Maudslay. The publishers also deserve congratulations upon a high standard of production. R. A. PETERS.

Brighter Optics

(1) Introduction to Physiological Optics
By Prof. James P. C. Southall. Pp. x + 426 + 3 plates. (London, New York and Toronto: Oxford University Press, 1937.) 21*s*. net.

(2) The Science of Seeing
By Dr. Matthew Luckiesh and Frank K. Moss. Pp. viii + 548 + 1 plate. (London: Macmillan and Co., Ltd., 1937.) 25*s*. net.

(1) ENGLISH-SPEAKING scientific workers already owe much to Prof. Southall, since it was he who edited the English translation of Helmholtz's great work on physiological optics. Prof. Southall's aim in the present volume is to give his readers a general introduction to the broad science of light and vision which, without being too prosaic, would be accurate and trustworthy so far as it goes. Every observation dealing either with the physiology of the eye or with its optical properties found a place in Helmholtz's "Physiological Optics". It was, in fact, a text-book describing the normal working of the organ of sight. Only a rare genius like Helmholtz could make himself a master of both aspects of the subject, and since his time there has been a widening gap between them. It is doubtful whether the term 'physiological optics' is to-day a sufficiently descriptive title for a book on vision.

The chapters on the optical system of the eye, correction eyeglasses, and the movements of the eyeball are of a high quality. The author is here on firm ground and his literary style is quite crisp, but his treatment of the subject, although comprehensive, is not elementary. The first chapter to deal with optical questions ignores thin lenses, and plunges almost immediately into a formal statement of the geometrical optics of thick lenses—a very specialized subject.

The treatment of the biological aspects of vision is far less satisfactory. Workers on the physiology of the eye have tried hard during the last ten years to free the subject from the dogmas which in the past have brought on it such discredit. Relics of the past persist, however, for, in answer to an examination question, "State the main facts of colour vision", nine out of ten students will begin their answers, "There are two rival theories of colour vision . . ." Much has been done to improve this state of affairs, and it is a great pity that Prof. Southall has not referred to the works of Adrian, Ames, Granit, Hartline, Hartridge, Stiles and others; Fincham is classed as an "also ran".

In parts the author is grimly determined not to be dull:

"a sprightly disposition is mirrored in an active pair of eyes that are incessantly darting this way and that. . . . Such eyes can speak all languages and need no interpreters. A downcast look, a scornful glance, a soulful gaze, these and many similar expressions are in common use to describe this interplay of the eyes which conveys so much meaning not only in the intercourse of human beings with each other but also between man and beast. What can be more beautiful and expressive than the eyes of a dog watching intently his master's slightest gesture."

(2) Prof. Southall has covered a very wide field dealing with visual problems, and it is surprising that so much is left over that Dr. Luckiesh and Mr. Moss can still find enough material to fill another large book about the eye, this time dealing with the practical aspects of vision and illumination. It is a great pity that there is such a sharp distinction between two aspects of the same subject as exemplified by these two books, for the problems are basically the same. "The Science of Seeing" is much the most serious book to be written by Dr. Luckiesh and his collaborator. Dr. Luckiesh is the director of the lighting research laboratory, General Electric Company, Cleveland. For many years he has been urging us to raise the level of artificial illumination. He does not believe in half measures. The existing level of domestic artificial illumination lies between 1 and 10 foot-candles. Dr. Luckiesh says:

"Similar measurements applied to various visual tasks in homes, schools, offices and factories indicate that hundreds and even thousands of foot candles are necessary even to reach the conservative standard of visibility adopted for the present purpose of demonstrating the use of the visibility method of prescribing foot candles on a rational basis. Engraving and sewing require 500 to 3,000 foot candles" (p. 343).

Illuminations of this order would render rooms so hot that they would be uninhabitable unless a special cooling plant were installed. One is always a little surprised when those interested in high illuminations advocate their use for the good it does our eyes, whilst at the same time disclaiming all responsibility for the harm the resulting high temperatures would do to the rest of the body. It is to be hoped that interested parties will not wreck an admirable campaign for better artificial illumination by attempting to advance too quickly.

Illuminating engineers have received little support from biologists interested in vision, and one cannot blame Dr. Luckiesh and Mr. Moss for attempting to fill some of the gaps in our knowledge. They claim, for example, that the heart-rate is reduced to its resting level more rapidly when reading under an illumination of 1 ft. c. than when reading under 100 ft. c. Since the authors claim that the speed of reading was much the same under the two illuminations, most people might be forgiven for wishing to perform a given task under the lower illuminations, thereby saving some unnecessary heart-beats. For restful conditions in the home it would seem necessary to have low illuminations.

It is clear that the 'science of seeing' has not advanced far: 'physiological optics', although growing fast, appears to be not yet strong enough to give a helping hand. R. J. L.

An Encyclopædia of Music

The Oxford Companion to Music

By Dr. Percy A. Scholes. Pp. lv+1091+179 plates. (London, New York and Toronto: Oxford University Press, 1938.) 21*s*. net.

MR. WELLS'S "World Encyclopædia" has not, as yet, materialized, but encyclopædias and dictionaries are now appearing which, if they do not show that unity of plan which should dominate the work that Mr. Wells has in mind, may yet be regarded as its precursors. The "Oxford Companion to Music" conceals, under its modest title, a vast amount of learning, set out in orderly and scholarly fashion, and designed to provide clear and exact answers to the thousand-and-one questions raised by any inquiring and intelligent amateur of the art. It would be idle to expect to find, even within the compass of nearly eleven hundred large octavo pages of small print, detailed treatises on harmony, counterpoint, singing, the pianoforte, the organ, and so forth. But Dr. Scholes does better. He gives succinct accounts of the fundamentals of the technical side of the art, sufficiently detailed to give the reader a firm grasp of the elements of the subject, and in many instances provides pointers which show where further information may be obtained.

It is difficult, within the compass of a short notice, to indicate adequately the scope of the information given in this truly encyclopædic work. As was to be expected, nothing of importance on the technical side has been omitted. Over and above this, one finds scholarly articles on such diverse topics as music-halls, hymns and hymn tunes, mis-attributed compositions, "God Save the King", concerts and concert halls, the printing of music, the profession of music, and the like. Analyses of the plots of the classic operas are provided, and the work abounds in biographical details. The scientific articles are brief but adequate—the article on acoustics being a model of its kind. Wherever possible, the treatment lays stress on the evolutionary aspect of the subject, and Spencer's definition of evolution as a change from

"an indefinite incoherent homogeneity to a definite, coherent heterogeneity" receives more than one illustration.

The author has a light touch, and his handling of some topics (see the article on absolute pitch) becomes easily conversational without in any way becoming discursive. It must not be assumed that the author has been unmindful of Leslie Stephens's warning—"No flowers, by request"—to contributors to the "Dictionary of National Biography", but the fact remains that his treatment of many topics is so thoroughly absorbing, so admirable an example of the art that conceals art, that there is a danger of the book's becoming a pleasant fireside companion rather than a volume for the reference shelves.

The author has consulted experts in many friends, and has done so in the true spirit of Boswell, receiving the corrections with deference, but not always agreeing with them. He is to be warmly congratulated on the completion of a single-handed effort the magnitude of which cannot often have been equalled or exceeded.

The book is admirably produced, is profusely illustrated, and should indeed prove to be a Good Companion to all lovers of the art of music. But why omit all mention of Sims Reeves?

A. F.

Plant-Life of the French Mediterranean Region

La distribution géographique des végétaux dans la région méditerranéenne française

Par Ch. Flahault. Œuvre posthume publiée par H. Gaussen. (Encyclopédie biologique, Vol. 18.) Pp. xi+180+4 plates. (Paris: Paul Lechevalier, 1937.) 100 francs.

BOTANICALLY the Mediterranean region is one of the best defined of the larger floristic and ecological divisions of the earth's surface. This is because of the high constancy of the seasonal distribution of temperature and rainfall maxima and minima. Data are not yet sufficient for an adequate survey of the whole region, which includes considerable parts of southern Europe, northern Africa, and western Asia, but the work here noticed is a valuable contribution to such a survey, in that it brings together especially the results of the author's numerous studies of the plant-life of a very typical and well-worked area of the western Mediterranean Basin. The work is published posthumously, since Flahault died in 1935, and was awarded the Gay Prize in 1937 by the Paris Academy of Sciences.

Much of the book is naturally concerned with details of the distribution of species and vegetation in the south of France, but many broader discussions and comparisons are included. The flora of the French Mediterranean basin is said to include about four thousand species of vascular plants; but a considerable number of these have a wide distribution extending far beyond the limits of the Mediterranean region. The interesting question of 'characteristic' species is discussed at some length. The high value which has been assigned to the olive as the sole or main indicator of the limits of the Mediterranean region (in France) is disputed on strong grounds. It is concluded that "le Chêne vert" (*Quercus Ilex*) "est partout, dans le bassin française de la Mediterranée, ou règne le climat mediterranéen; il est partout où se développe la flore méditerranéenne dans les limites du bassin. *Il est le terme principal d'une association* de végétaux qui *caractérise* la région méditerranéenne, mieux que tout autre caractère."

The limitrophic regions (of the halophytes, mountains, etc.) are briefly considered, and the French Mediterranean region proper is divided into three sectors as the result of a very full analysis of environmental conditions and their correlation with characteristic species and types of plant communities. Four maps form a valuable aid to a clear understanding of the text. One of the maps, particularly well printed in a wide range of colours and coloured patterns, shows the distribution of the main communities.

The influence of man on the existing flora and vegetation of the area is considered to be limited. The conclusions reached are exceedingly interesting, partly because they differ in some respects from those of other workers in other parts of the Mediterranean region. Thus Flahault definitely says that man has not profoundly modified the flora, even with reference to forest species; that man has unintentionally caused the extinction of relatively few species; and that man has introduced very few species which have become naturalized to the extent that they would survive in competition with the native plants were the human 'protecting' conditions removed. Naturally occurring species survive destruction, for at least very long periods, by a kind of passive resistance. Man's 'troubling of nature' is ephemeral, even in a country of ancient civilization, and Nature necessarily regains her rights as soon as the modifying agent is removed.

W. B. T.

Social Ecology:
a Critical Analysis. By Milla Aïssa Alihan. Pp. xiii+267. (New York: Columbia University Press; London: Oxford University Press, 1938.) 14*s*. net.

THE author discusses theoretically the use of the concepts of plant biology in considering human phenomena. The advances made by the human sciences in recent years may be attributed largely to the introduction of biological methods and ideas into these studies. Human ecology is an extension of this principle. It has been defined as "the study of the spatial and temporal relations of human beings as affected by the selective, distributive and accommodative forces of the environment".

The so-called ecological school in the United States is still, apparently, in the stage of clarifying its fundamental concepts and has, so far, little experimental work to show.

The present work is largely a commentary and exposition of the principles laid down by the pioneers of human ecology in the United States such as Park, Burgess, McKenzie and others. The author's discussion might well have been more critical.

Writers in Great Britain like Hogben frequently stress the need for a planned ecology of human life, while Pearl, Charles and others have discussed population problems in the light of animal and plant ecology.

There is no doubt, as the author shows, that a great deal of light can be thrown upon human life by the use of ecological concepts such as concentration, centralization, segregation, invasion, zonation and so on, which also enable us to study social phenomena of a new type. Psychologists may, however, query the validity of postulating fundamental principles such as competition as the motive force in the formation of a community or natural order. Perhaps the rather novel way in which competition is defined, namely, in the sense of mobility, freedom of movement or independence of locomotion, makes the idea more acceptable, though it might be equally appropriate to identify 'freedom of movement' with a co-operative community instead of with a competitive one as the ecologists do. J. I. COHEN.

The Hills of Lakeland
By W. Heaton Cooper. Pp. xviii+126+52 plates. (London and New York: Frederick Warne and Co., Ltd., 1938.) 15*s*. net.

THOSE who know and love the Lake District will like this book: those who do not know the former can learn to love it through the latter. The text is obviously from the pen of one who has learned to love his native Lakeland. He describes the past and the present of a gem of English scenery in a style so facile and clear that the reader is transported as in a dream through crags and fells that alas have never been seen by many. He pays justifiable tribute to a region of great natural beauty and leaves the reader with a longing to down tools and indulge in the dream he has created. The dream, too, often amounts almost to reality through the beautiful illustrations which adorn the text. There are sixteen plates in colour and thirty-six plates in monochrome which have been executed by the author. These pictures make the book.

To realize and appreciate the majesty of Lakeland it is essential to know its past history. Therefore, the author describes well its geology, with the aid of maps.

Well-produced and beautifully illustrated books of this kind can do as much as, if not more than, any other form of propaganda to encourage appreciation and preservation of our natural heritage—the countryside.

Newer Methods of Volumetric Chemical Analysis
By Erna Brennecke, N. Howell Furman, Hellmuth Stamm, Rudolf Lang and Kasimir Fajans. Wilhelm Böttger, Editor. Translated by Prof. Ralph E. Œsper. Pp. xiii+268. (London: Chapman and Hall, Ltd., 1938.) 18*s*. 6*d*. net.

ALL who make any considerable use of volumetric analysis will find this monograph of great value, for not only does it treat of the most recent advances but also, in addition, the editor has secured the co-operation of a number of recognized experts to deal with the various sections of this symposium. The topics discussed are: (1) The elimination of the titration error in acidimetry and alkalimetry; (2) ceric sulphate and (3) alkaline permanganate as volumetric oxidizing agents; (4) iodate and bromate methods; (5) chromous solutions as volumetric reducing agents; (6) oxidation-reduction indicators and (7) adsorption indicators.

In each section there is an excellent blend of theoretical and practical exposition, while to each chapter there is appended a selected bibliography which includes papers up to the end of 1936. The monograph has been excellently translated from the second German edition and is well printed and produced.

The Lyre-Bird:
Australia's Wonder-Songster. By R. T. Littlejohns. Pp. 12+30 plates. (Sydney and London: Angus and Robertson, Ltd., 1938.) 4*s*. 6*d*.

TO take motion photographs in heavy forest successfully is no easy matter, and Mr. Littlejohns and his collaborator, Mr. A. H. Chisholm, would have had to give up the attempt if they had not received assistance from the Federal Government. The final result was an excellent sound film which the Government now uses for propaganda purposes.

Mr. Littlejohns has written an interesting account of the lyre-bird and has supplied to the different 'cuts' from the film appropriate letterpress. From these serial pictures we see that the tail, when in full display, is spread forward over the back in the shape of a fan, with the two lateral feathers at right angles.

The lyre-bird is also a fine songster, and in its mimicry is unsurpassed. It has been known to copy the notes and calls of no fewer than seventeen different species, and other sounds as well, such as the tearing of bark by black cockatoos.

Science in Industry*

THE twenty-third report of the Department of Scientific and Industrial Research, which covers the period October 1, 1937–September 30, 1938, includes the report of the Committee of the Privy Council signed by Lord Runciman, and the longer report of the Advisory Council over Lord Riverdale's signature, together with summaries of the work of the National Physical Laboratory and other research stations and research boards and brief accounts of the work of the various research associations. Like previous reports of the Department, the present one gives a most impressive picture of the immense contribution which the work of the Department is making not only to almost every type of industry but also in all aspects of national life.

The expenditure of the Department in 1937–38 was £872,127 gross or £637,200 net as against £583,230 net in 1936–37. As usual, the largest single item of expenditure was £110,907 on the National Physical Laboratory, compared with £105,589 in 1936–37, the gross expenditure of £252,209 including the cost of work at the Laboratory for the Food Investigation Board, the Radio Research Board, the Road Research Board and other research boards of the Department. Against this gross total, receipts amounted to £141,302, of which £69,822 represents fees from industry for paid work. The total receipts from industry, including contributions to co-operative research, amounted to £98,452 as against £106,250 in 1936–37, while a further £81,923 was received from other Government Departments for services rendered, £33,337 from the Road Fund for the road research and £6,282 from the Empire over-seas for food investigation. Expenditure on fuel research was £103,240 gross or £94,782 net, on building and road research £97,382 gross or £40,626 net, on the Chemical Research Laboratory £23,340 net, on food investigation £54,709 gross or £45,307 net, on forest products research £38,841 net, on water pollution research £9,134 gross or £5,421 net and on the Geological Survey and Museum, £71,472 net. Grants to research associations, etc., amounted to £148,282, as against £120,510 in 1936–37 and £108,951 in 1935–36, and the report notes the formation of a new research association, the British Coal Utilization Research Association, bringing the number of such associations to twenty-three.

The report refers to the dissolution of the Radium Beam Therapy Research Board, but the investigation for which it was responsible will be continued under the general control of the Committee of the Privy Council for Medical Research, and the Department will continue to keep in touch with the physical investigations included in the general programme of research. The Welding Panel of the Steel Structures Research Committee has also been discharged during the year upon the completion of some outstanding work, as well as the Standing Conference on Timber Utilization.

Food

A large part of the report of the Advisory Council is devoted to a review of progress in food investigation in recent years. The food investigation organization of the Department has now completed twenty years of work, and under present conditions the work that was begun in the face of a serious shortage of food has lost nothing of the national importance which was attached to it in 1937. Indeed, questions of storage no less than of transport of food are now regarded as an essential, if not a decisive, element in a national policy of defence, and the importance of this phase of the Department's work to the whole community need not be further stressed. From the start, this work has been concerned to avoid loss and wastage, during handling and storage, in the supply of foodstuffs and to ensure that this supply is made available in the best condition. Throughout the period, the need of the consumer has been the governing consideration, and the Food Investigation Board has found solutions for all three of the great problems which confronted it at the start.

The problem of the preservation of fruit, much of which responds badly to ordinary cold storage, has been solved by the development of 'gas-storage', a new method in which the ventilation of cooled stores is adjusted so that their atmosphere contains just the right amount of carbon dioxide. Ten years ago there were no gas-stores. To-day they provide three million cubic feet of storage, and this is only a beginning. Again, up to 1933, Australia and New Zealand still had to send their beef to Great Britain in the frozen state, when it is not a satisfactory product. Now it has been shown that chilled beef can be preserved for long periods in special chambers enriched with carbon dioxide, and in 1937 Australia and New Zealand sent us some three quarters of a million hundredweight of chilled beef carried in this way.

* Department of Scientific and Industrial Research. Report for the year 1937-38. (Cmd. 5927.) Pp. iv+203. (London: H.M. Stationery Office, 1939.) 3s. net.

The third problem, that of handling and preserving fish, which is highly perishable, and as ordinarily handled and stowed cannot be kept really fresh for more than ten to twelve days, has also been solved by the development at the Torry Research Station of brine freezing and cold storage at a low temperature. By the new methods lemon soles have been stored for two years and were in excellent condition at the end of that period. Success in these fields has been achieved, as the Advisory Council's report insists, by building up, however slowly, a science of the storage and transport of food, and the achievements of the Department in regard to food investigation are a remarkable tribute to the service which science can render in everyday life.

The present report refers to other work in progress, including investigations of the changes in muscle post mortem, the rancidity of edible fats, the causes of rotting of eggs, the factors which affect the composition and structure of the fatty and muscular tissues of the pig and the quality of the bacon which depends upon them, the distribution of vitamin A in fish, the cold storage of herrings, the spoilage of haddock in crushed ice and chemical indexes of freshness. The work on gas-storage has covered the storage of Cox's Orange Pippin apples and English-grown William pears, and studies in the resistance of apples to fungal invasion have also been continued, as well as on the experimental storage of broccoli, the freezing of vegetables for preservation, the thermal properties of butter, and on the relation between the rate of formation of hydrogen swells in cans filled with various fruits and the rate of corrosion by acid of the steel base of the tin-plate used in their manufacture. The Advisory Council has now further invited the Board to review the whole field of research into the processing of foodstuffs and to submit proposals for embracing under its scientific supervision work in this field which is desirable in the national interest.

A further special aspect of food research is stressed in the report of the Advisory Council—that of preventing the loss of stored foodstuffs by attack. The destruction of grain by weevil and other pests is estimated to cause a loss in Great Britain of £500,000 annually, a figure which might easily be exceeded if the problem is left unsolved while the plans for storing grain in the national defence policy are developed. The Department has now accepted the responsibility for a survey of the infestation of grain and grain products in this country, covering all stages in the handling of the grain, from harvesting or arrival at the port to delivery to the consumer. A standing conference, representing all the industrial interests desiring to co-operate, has been established as a consultative body, on which brewers, corn merchants, flour millers, railway companies, cattle food trades, wharfingers, maltsters, lightermen, farmers and port authorities are represented, and the work was commenced in May by the staff of the Stored Products Laboratory at the Imperial College of Science and Technology, London, under Prof. J. W. Munro.

Besides the work of the Food Investigation Board, several of the research associations have made important contributions to our knowledge of foodstuffs and dietary problems. The Research Association of British Flour Millers, for example, has been responsible for important investigations into the nutritive value of bread which have emphasized the importance of bread and lard, or bread and butter in the dietary, and other work has been concerned with developing the instrument for measuring and recording graphically the baking quality of flour and the conditioning of wheat prior to milling.

Investigations carried out by the Research Association for the Cocoa, Chocolate, Sugar Confectionery and Jam Trades, on the properties of different white sugars used for certain confectionery processes, have indicated that the differences in behaviour were due to differences in minute quantities of impurities in the sugars. This discovery has led to new operating methods and also substantial savings of sugar, and further investigations of the same type have shown that complaints by employees that certain brands of sugar were unsatisfactory for a specific purpose were justified. Other investigations of the Association have advanced our knowledge of the properties of pectin compounds and afforded a new explanation of the phenomena of jelly formation. The Food Manufacturers' Research Association has obtained important results in bacteriological investigations on the curing of bacon and hams, as well as on the canning of meat and on the corrosion and perforation of the cans and the methods of lacquering the cans to prevent corrosion.

Light Industries

Other research associations are making equally important contributions in the field of clothing. The Boot, Shoe and Allied Trades' Research Association, continuing its work on occupational footwear, has made good progress in research to discover the best styles of footwear for various kinds of employment, and other investigations commenced during the year deal with the influence of heel height upon poise. The results obtained in this intrusion on the thorny problem of the effect of high-heeled shoes on health suggested that the best height is governed by a woman's occupation

and the customary poise which her occupation may impose.

The Wool Industries Research Association has continued its investigation on shrinkage-resistant wool, including an entirely new type of reaction, which consists in the use of proteolytic enzymes of the type of papain whose activity can be controlled chemically and which appear to have specific action on certain regions of the wool fibre. Other work has been concerned with the rubberization process, the measurement of shrinkage in fabrics due to milling and laundering, and the fastness of dyed materials to washing. The Linen Industry Research Association has continued its work in relating yarn and fabric properties, and on degradation and fading of fabrics used for casements and awnings; it is now possible to select vat dyes which decrease the chances of premature deterioration. Similarly the British Launderers Research Association's investigations have thrown much light on the mechanics of the first part of the washing process, and its bacteriological investigations have shown that goods washed and finished in the laundry are much more nearly sterile than goods washed and dried in the home.

The British Leather Manufacturers' Research Association has continued its investigations on the chemical basis of the finishing process, and an X-ray plant has been installed for studying the effect of the various tanning processes on the internal structure of the fibres. The physical and microscopical characteristics of chrome calf and of glacé kid have been examined with the object of obtaining better quality leather for boot and shoe uppers. The Research Association of British Rubber Manufacturers has devised a method by which the ordinary dry raw rubber of commerce can be reduced to a fine granular condition by a simple process requiring no special machinery beyond that ordinarily used in rubber manufacture, while its investigations on ebonite have aimed at obtaining a material better suited to modern needs.

The Printing and Allied Trades Research Association has now passed a year in its new laboratories, and has completed an investigation into the causes of the tarnishing of bronze printing used in the decoration of goods for confectionery and cigarette wrappers, which has traced the tarnishing to minute quantities of compounds containing sulphur in the paper, ink or adhesives used. A method of determining these small quantities of sulphur has been devised which enables the materials to be tested as to their suitability. The Research Association of British Paint, Colour and Varnish Manufacturers has completed investigations on the surface characteristics of pigment particles and their physical form in relation to their behaviour in paint, as well as on the role of oxygen in the formation of films by drying oils and varnishes.

Heavy Industries

It is impossible in the space at our disposal to refer to the work of all the research associations even, but three more examples can be given to illustrate how their activities contribute to almost every side of the amenities no less than of the necessities of society. The Electrical and Allied Industries Research Association has been giving attention to problems arising in making electricity supply more readily available to farms and in its more efficient application to agriculture and horticulture, as well as to the prevention of interference with broadcasting, the study of surge phenomena with the view of minimizing damage and inconvenience due to lightning, and the design of flame-proof mining switchgear. The British Non-Ferrous Metals Research Association has investigated the behaviour of copper pipes and galvanized tanks in the domestic water system, while the work of the Cast Iron Research Association has led to the development of cast iron with a tensile strength of more than sixty tons per square inch, although a few years ago a strength of more than about twelve tons per square inch could not be obtained.

Fuel

Investigations carried out by the Automobile Research Committee on the factors which affect the starting of automobile engines in the cold have shown that by an apparently minor modification in engine design the power of the engine to overcome its own internal friction can, under certain conditions, be doubled. Further investigations under this Committee have dealt with the tendency of piston rings to stick in their grooves, due to the formation of gum in the lubricating oil under the high-temperature conditions, and a comparatively simple test has been developed for measuring the gum-forming propensities of lubricants. Besides its chemical and physical survey of the national coal resources, the Fuel Research Board has dealt with the preparation of coal for the market and has continued its work on the hydrogenation of coal and tars to oils and motor-spirits and on the synthesis of hydrocarbons and the production of lubricating oils.

National Physical Laboratory

Turning now to the activities of the National Physical Laboratory, special stress is laid on the work carried out in regard to the testing of the electrical switch gear. The development of the

grid has entailed transmission of large amounts of power at high voltages and has called for much patient research into means for its control. An important problem is the provision of switchgear designed to ensure the safety of operators and to protect electrical equipment against accident. No public station is available for examining the behaviour of new designs and circuits reproducing serious conditions of overload which sometimes occur in service.

While the Department was considering the possibility of erecting such a station, a proposal for co-operation was made by the association of manufacturers owning the existing stations. It offered to open its stations to tests for any British manufacturer, with a guarantee that testing-time would be available at the stations as a whole equivalent to the full time of a Government station of the type contemplated. Moreover, it agreed to accept a measure of supervision of the tests by the Department which would make possible the issue of a National Physical Laboratory certificate for switchgear which passed agreed standards of performance. Such standards have already been drawn up by the British Standards Institution to cover circuit breakers of medium and high capacity. The negotiations necessary to accept this offer have been completed and the National Physical Laboratory is now prepared to accept orders for testing electrical switchgear designed to operate at voltages between 3,300 and 11,000 volts and up to capacities not exceeding 250,000 kva. for compliance with the provisions laid down in the appropriate British Standards specification.

Much important work has also been carried out at the Laboratory on the reduction of noise, including an investigation into the noise of motor-horns, while investigations are in progress for the Institution of Automobile Engineers on the silencing of motor-cycles and the reduction of drumming in motor-car panels, as well as on the lessening of noise in tube trains. Other work has been carried out in association with the Building Research Station on the transmission of sound through walls, floors and building materials, while in another department problems of illumination involving street lighting and the effect of illumination by the headlights of a motor-car under both dry and wet conditions have been investigated. An interesting side investigation has been that of the possibility of controlling the movement of eels in water by electrical fields, undertaken by the Laboratory at the request of the Ministry of Finance for Northern Ireland, instigated by the necessity of devising some alternative form of fishing owing to the obstruction to the discharge of water by an existing eel weir in a large drainage scheme on the lower Bann River. In this investigation the possibility of diverting eels electrically on a small scale appears to have been established.

Building and Road Research

The Building Research Board, with its research station at Watford, has continued its work on the efficiency of buildings from the point of view of the user, and has been associated with the investigation on the strength of existing road bridges being undertaken for the Ministry of Transport.

The Road Research Board has continued its studies on the problem of skidding and on bituminous surfacings, in which the behaviour of the surfacings on a public highway is being compared directly with their behaviour on one of the road machines at the laboratory. It has also been associated with the Timber Development Association in investigations of the properties of wood block paving. A special investigation is being carried out for the British Rubber Producers Research Association on the effect of incorporating chlorinated rubber with tar.

Miscellaneous

The Forest Products Research Board has been responsible for investigations ranging over the fire resistance of timber, the control of the death watch beetle or the lyctus powder post beetle, glues and adhesives and the chemistry of wood. The Water Pollution Research Board has covered the base exchange process of water softening, the exchange properties of synthetic resins, the contamination of water by lead and the problems arising in the treatment and disposal of dairy waste water. Attention has also been given to the physical, chemical and biological changes which occur in the purification of domestic sewage by the active sludge process, while under the Chemical Research Board investigations have ranged over the preparation of new chemotherapeutic products, the evaluation of antiseptics, the tendering of tarred cordage, immersed corrosion and chemical reactions at high pressure. The cause of persistent contamination of beer by a sulphurous odour has also been investigated and the trouble removed. The variety of bacteria which are responsible for the trouble has been isolated, and the infection has been traced to the cellar floors of the brewery.

The Radio Research Board has completed its studies of the ionosphere and of the propagation of waves along the ground and through the atmosphere, which have become of direct practical importance with the increased use of ultra-short rays for communication purposes. Other work has dealt with problems of direction finding.

The Department has also been responsible for illumination research, including the daylight problems involved in illumination conditions in deep rooms and the standardization of lamps and fittings. Lubrication research carried out by the Department has included measurements of static friction, as well as work with the four-ball high-pressure testing apparatus and on the physical properties of surfaces. Atmospheric pollution, the detection of toxic gases in industry, the development of a respirator for use in dust-laden atmospheres, X-ray methods and measures conducive to greater safety in handling gas cylinders and containers have all come within the orbit of the Department.

The present report gives a most impressive picture not only of the way in which the work of the Department of Scientific and Industrial Research serves almost every aspect of everyday life no less than the needs of industry, but also of the admirable way in which its organization is adapted for co-operative work on the many problems that are brought before it by industry or by national needs.

Marine Biology in South Africa

By Prof. R. S. Adamson and Prof. T. A. Stephenson,
University of Cape Town

SINCE 1932, an ecological survey of the South African coast has been in progress, carried out from the Departments of Botany and Zoology of the University of Cape Town. The survey is necessarily expensive, since it extends from Durban in the east to Port Nolloth in the west, covering a coastline between one and two thousand miles in length, parts of which are almost inaccessible. The expenses were defrayed, in the early stages, by the University of Cape Town and the South African Research Grant Board, with some private contributions; and assistance has also been received from the Royal Society of London. At the present time, expenses are being met from a generous grant made to the University by the Carnegie Corporation of New York.

The survey has been carried out by more than a dozen persons, but the principal contributions have been made by T. A. and Anne Stephenson, E. J. Eyre, G. F. Papenfuss and K. M. F. Bright. At present, thanks to the Carnegie grant, the survey employs three salaried research assistants and has been able to purchase a Chevrolet van for field-work.

The ecological results of the survey, up to the present, are being published in three periodicals. Accounts of specific areas on the coast have appeared during 1937–38 in the *Transactions of the Royal Society of South Africa* (**24** and **25**) and in the *Annals of the Natal Museum* (**9**). The first part of a general account of the results, as they affect the whole coast, is being published in the *Journal of the Linnean Society of London* (**40**). In addition to these papers by field-workers on the survey, systematic accounts have been published by specialists to whom collections, made in the course of the field-work, have been sent for identification. Altogether the survey has so far been responsible for the appearance of thirty-two papers, references to which will be found in the publications just mentioned.

Material collected during the survey and belonging to certain animal groups is identified by specialists on the staffs of the South African and Natal Museums, and many of the algæ are identified by Dr. Papenfuss, who is engaged upon a revision of the whole of the South African algæ; but the greater part of the material has to be sent to specialists at various European or American centres, notably the British Museum. Throughout the survey, steady support has been received from this circle of systematic workers, invaluable assistance without which the continuation of the investigation would have been impossible. Sincere thanks are offered not only to these systematists, but also to those who have assisted the survey by publishing results, and particularly to Dr. R. F. Lawrence of the Natal Museum. Duplicates of all collected material are retained at the University of Cape Town for future reference.

The survey has hitherto been confined to a study of the rocky parts of the intertidal belt. The scope and aims of the investigation are detailed in the first paper[1] of the series mentioned above, but briefly it may be said to consist of three parts: (1) a general study of eight districts situated at intervals along the coast, from Port Nolloth in the west to Durban in the east; (2) a further study, at as many stations as possible, between the eight already mentioned; this section of the work to deal mainly with a selection of common organisms which have been shown by the eight primary surveys to be of particular importance; and (3) a series of experimental studies designed to explain the observed distribution in the field of ecologically important

organisms, in terms of their reactions to carefully controlled conditions in the laboratory; special attention being paid to temperature.

The reason why a survey of this nature is of particular interest in South Africa is found in the local arrangement of oceanic currents. The coast of Natal is markedly influenced by the southward-flowing warm Mozambique-Agulhas current, which renders the inshore water sub-tropical in temperature, although Durban is far south of the Tropic of Capricorn. The inshore water along the west coast of the Union, on the other hand, is almost sub-antarctic in temperature (particularly in its northern part), as the result of an upwelling of antarctic intermediate water. The tropical regions of the coast are therefore, as it were, displaced southward on the east coast and northward on the west. The south coast (Cape Point to Cape Padrone) is a region where the inshore water is of an intermediate average temperature, the influence of neither the coldest nor the warmest water of the other coasts being paramount. The situation is particularly interesting in the vicinity of the Cape Peninsula, on which Cape Town is situated, since here a narrow tongue of land, on the average about five miles wide, separates water-masses which, in summer, may differ from each other in temperature by as much as 8° C. The arrangement of currents is in fact more complex than this paragraph would suggest, but cannot be described in detail in an article of this nature.

The results of the initial phase of the survey show clearly that the South African intertidal belt has three principal populations of animals and algæ, distributed in accordance with the arrangement of currents described, and apparently controlled primarily by temperature. In Natal, the population consists partly of 'Cape' species, but a high percentage of the biota belongs to the great tropical Indo-West-Pacific group, and includes reef corals and many species which characteristically inhabit coral reefs. On the south coast (and indeed on the southern part of the east coast also), the bulk of the conspicuous tropical species has disappeared, and the population is a typical 'South African' one, with many endemic species. In the cold water of the west coast a third population holds the field. It should be understood that although these three series of organisms are undoubtedly distinct, if regarded as wholes, there is much overlapping, and although each group includes species which are confined to, and extend little beyond, their own optimal area, other species are common to two, or even all three, of the main geographical regions.

Although the survey has hitherto been primarily concerned with zoogeographical considerations, several specific side-lines have been followed up, and these include detailed studies of the bionomics of the South African Patellidæ[2], and of the intertidal snail-like gastropods[3], together with investigations of the oxygen conditions in rock-pools[4] and of the recolonization of denuded intertidal areas[5].

[1] *Trans. Roy. Soc. S. Africa*, **21**, 242–4).
[2] Stephenson, T. A., *Proc. Linn. Soc. Lond.*, **148**, 74 (1936).
[3] Bokenham, N. A. H., Neugebauer, F. L. M., and Stephenson, T. A., *Ann. Natal Mus.*, **9**, 113 (1938).
[4] Stephenson, T. A., Zoond, A., and Eyre, J., *J. Exp. Biol.*, 11, 162 (1934).
[5] Bokenham, N. A. H., and Stephenson, T. A., *Ann. Natal Mus.*, **9**, 47 (1938).

Epicentres of Earthquakes, 1913-1932*

By Ethel F. Bellamy, University Observatory, Oxford

THE Seismological Committee of the British Association has since 1911 made itself responsible, in a greater or less measure, for collating the records of earthquakes made by seismological stations all over the world. The work of computing the epicentres was first undertaken by Prof. John Milne at Shide, and on his death was taken over by Prof. H. H. Turner, who gave the *International Seismological Summary*† (formerly the *Bulletin of the B.A. Seismological Committee*) the form it now bears. Such determination of epicentres, based on least squares solutions of the recorded times of arrival of *P* waves at the various stations, now covers both accurately and completely all the medium and large earthquakes recorded in the period 1913–1932 inclusive. It is the purpose of the present note to direct attention to the geographical distribution of these epicentres.

During this period, 7,940 shocks have been recorded, and these have originated in 2,865 separate and distinct epicentres. The positions of these epicentres are plotted in Fig. 1, an equal area projection centred on longitude zero, latitude zero. Attention may be directed to the density

* Based on a communication at the Cambridge meeting of the British Association.

† Since the 1922 meeting of the International Union for Geodesy and Geophysics, the cost of preparation and publication has been met jointly by the International Seismological Association, the British Association, and the University Observatory, Oxford.

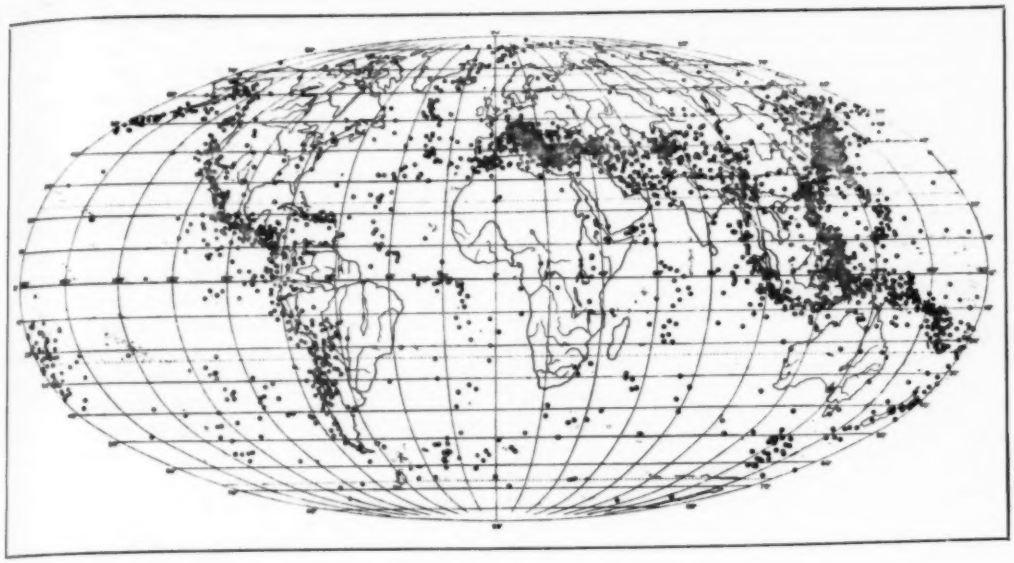

Fig. 1.

POSITIONS OF 2,865 EPICENTRES AS DETERMINED IN THE INTERNATIONAL SEISMOLOGICAL SUMMARY, 1913–1932, INCLUSIVE. (Map reproduced by permission of Messrs. Stanford, Ltd.)

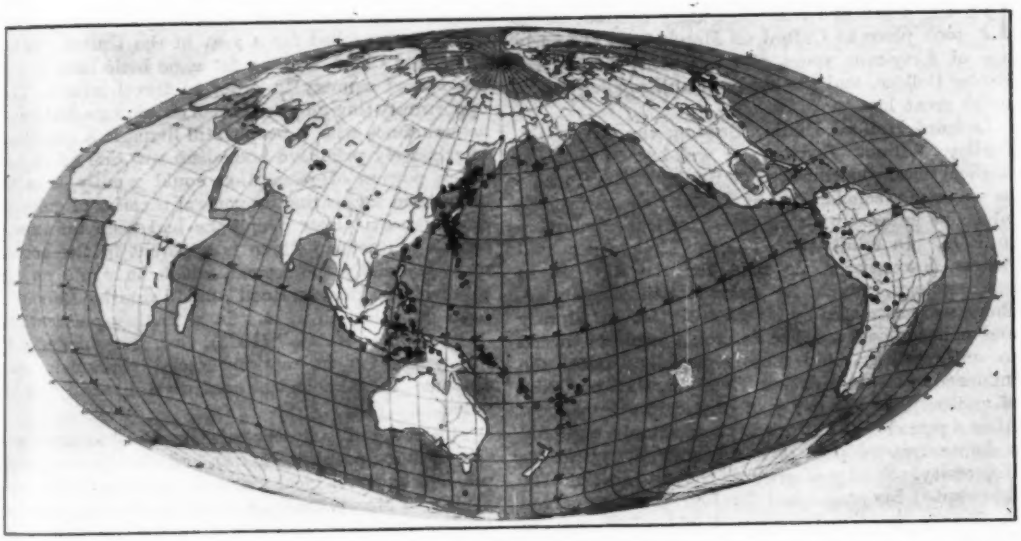

Fig. 2.

DISTRIBUTION OF 350 DEEP-FOCUS AND 30 SHALLOW-FOCUS EPICENTRES (1913–32).

On the original drawing the depth of focus is indicated by the nature of the circle, half-filled and filled, depending upon the depth, for deep foci, and with a central cross for shallow foci. Owing to difficulties of reproduction these distinctions will scarcely be discernible in the above figure.

(Map reproduced by permission of the American Museum of Natural History, New York.)

of epicentres in the Mediterranean zone, and along the east and west boundaries of the Pacific. Interesting, too, is the line of epicentres in mid-Atlantic, which follows so accurately the continental boundaries on either side, though whether this is due to a line of weakness or to a mere accident of distribution, the material available is still too small to settle.

Particularly interesting among these epicentres are those, to which Prof. Turner first directed attention[1], where the focus occurs at depths greater or less than normal. In the period concerned, there have been found 350 deep-focus and 30 shallow-focus epicentres; the positions of these are shown in Fig. 2, which is another equal area projection, centred on longitude 160° E. and latitude 20° N. It will be noted, as pointed out by Prof. Turner[2], on the basis of much less complete material, that the deep-focus epicentres appear to define the "boundary of an oval region about 180° long., centred with fair accuracy on the Equator, and enclosing a considerable part of the Pacific Ocean, though its eastern boundary intrudes into S. America".

Maps such as these, which are a by-product of the work of preparation of the *Summary*, are not only of interest in themselves, but also serve to emphasize the need for a more uniform distribution of seismological stations. While approximately one third of the recorded earthquakes in the period under review occurred in the southern hemisphere, not one eighth of the existing five hundred seismological stations are located in that hemisphere. It is clear that such a one-sided distribution of stations cannot fail to affect the distribution of recorded epicentres, and it is greatly to be desired that new stations, with the accurate timing now made possible by the wireless broadcast of time signals, should be established in South America and South Africa.

[1] *Geophys. Supp. Mon. Not. Roy. Ast. Soc.*, **1**, 1 (1922).
[2] *Inter. Seis. Sum.*, 1927, 1, 108 (1930).

Obituary Notices

Dr. L. H. Dudley Buxton

BY the death of Dr. L. H. Dudley Buxton, which took place at Oxford on March 5, at the early age of forty-nine years, the University of Oxford, Exeter College, and the study of anthropology alike suffer great loss.

Leonard Halford Dudley Buxton, the son of Dr. Dudley Wilmot Buxton, a well-known London medical man, was educated at Radley College, where he was senior scholar, and at Exeter College, Oxford, which he entered with an open classical scholarship in 1908. In addition to Honour Moderations and *Literæ Humaniores*, he read for the diploma in anthropology, which he gained with distinction. Being more attracted by his scientific than his literary and philosophical studies, Buxton's interests turned to anthropology, and more especially, under the influence of the late Arthur Thomson, then professor of anatomy, to the study of physical anthropology. After a period of field work in the Sudan, he accepted a demonstratorship in physical anthropology in his University. Shortly afterwards the outbreak of War interrupted his work, and for four years he served in France in the Cameron Highlanders and in Intelligence—the latter a duty for which his facility in languages peculiarly fitted him. At the close of the War he returned to Oxford to carry on his work as demonstrator in the anatomical department of the University Museum, performing a highly useful service in arranging, classifying and cataloguing the osteological material, much of it, in some instances almost or quite forgotten, of no little value and interest in the annals of physical anthropology.

Not long after his return to Oxford, Buxton was awarded the Albert Kahn travelling fellowship, with which he travelled for a year in the United States, India and China, staying for some little time in the last-named country in order to travel inland. The opportunity thus afforded him of obtaining a first-hand acquaintance with a people still living in a condition of relatively primitive nomadism was one which his quick powers of perception could readily turn to account in its bearing on general theories of cultural development. How deeply he had been influenced by his contacts in China is apparent in the books, more especially the second, which he wrote on his return, "The Eastern Road" and "Primitive Labour", both published in 1924. In a further publication, "The Peoples of Asia" (1925), also, the quickness of his perception in marking racial character, and aptitude in ethnological analysis are readily to be noted.

This power of analysis was not confined to investigation of living peoples. Buxton had already excavated prehistoric osteological material on Cretan sites, and a visit to Mesopotamia, as well as the examination of the material which came from the excavations at Kish and elsewhere, led to an account of the basic types of the early peoples of the region, which is perhaps, in the technical sense, Buxton's best piece of work. No less valuable in a different context was the survey, anthropological in the broadest sense, which Buxton initiated of the peoples of the remoter districts of Oxfordshire, in which folk-lore, social history and custom, and anthropometric observation combined to produce studies of lasting interest.

In recognition of his discovery among family papers of the lost correspondence of Descartes with Huygens Buxton was awarded the *Légion d'Honneur*.

In due course, Buxton was elected to a fellowship on the foundation of his College, of which later he became bursar. The business ability which he showed revealed capacities of which the University also readily took advantage. In carrying out these duties, his success was at least in some measure due to a geniality which had won him the affection of his pupils, his colleagues and his contemporaries.

Mr. Howard Carter

IT is with regret that we have to record the death, on March 2, of Mr. Howard Carter, the painter and archæologist, whose name will always be remembered as the discoverer of the tomb of Tutankhamen.

Born at Swaffham in Norfolk in 1873, Carter was the youngest son of Samuel Carter, the animal painter. Owing to delicate health he never went to a public school, but as a lad worked at painting with his father. At the age of eighteen years he first went to Egypt as a draughtsman on the staff of the Archæological Survey of Egypt, then being carried out under the auspices of the Egypt Exploration Fund. His earliest line-drawings were published in the present writer's "El Bersheh I" (1893), and many of his water-colour drawings of the animals and birds figured in the tombs at Beni Hasan, and executed in 1892, are reproduced in colour in "Beni Hasan IV" (1900). In 1892 he was for three months assistant to Mr. (now Sir) Flinders Petrie in the excavations that were then being carried out at El Amarna, Lord Amherst of Hackney defraying all Carter's expenses.

In the autumn of 1893 Carter was again in Egypt, this time as draughtsman to M. Naville at Deir el Bahari, and with Naville he worked for six years; the greater number of the plates of the six folio volumes of Naville's "Deir el Bahari" (1895–1903) were printed from Carter's drawings. In 1900 he was appointed inspector-general of the monuments of Upper Egypt under the Egyptian Government and during the four years that he held this post he did much restoration work in the temples of Western Thebes, Edfu, and Kom Ombo. In the Valley of the Tombs of the Kings he installed electric light in six of the more important tombs, and the electric light installation in the Temple at Abu Simbel in Nubia was also carried out by him.

In January 1902, at Carter's instigation, Theodore M. Davis, an American, undertook to finance a systematic exploration of the Valley of the Tombs of the Kings at Thebes for the benefit of the Services des Antiquités, and this work was entrusted to Carter. Among the discoveries he then made were the royal tombs of Tuthmôsis IV (Carter-Newberry, "The Tomb of Thoutmôsis IV", 1904), and Hatshepsût (Naville-Carter, "The Tomb of Hatshopsitu", 1906). When Lord Carnarvon began excavating at Thebes in 1908, Carter, at the express desire of Sir Gaston Maspero, then director-general of the Service des Antiquités, was appointed to supervise the excavations and record all 'finds'. After five years work, there appeared the handsome volume "Five Years Explorations at Thebes" by Carnarvon, Carter and others. In 1914 Carter by a lucky chance found the long-sought-for tomb of Amenhotep I (*J. Egyptian Archæology*, **3**, 147; 1916), and soon afterwards he located a tomb of Princess Hatshepsût, which the Arabs had recently found and plundered (*ibid.*, **4**, 107; 1917).

At the conclusion of the Great War, Carter persuaded Carnarvon to let him once again explore in the Valley of the Tombs of the Kings, and in 1922 he was rewarded by the discovery of the tomb of Tutankhamen with its extraordinary wealth of jewels and tomb furniture. Carter at once realized that only with the help of a large staff of expert workers could he attempt to clear the tomb of all the treasures it contained. Fortunately, this problem was quickly solved through the generosity of the Egyptian Expedition of the Metropolitan Museum of Art, New York. In answer to Carter's appeal, Mr. A. M. Lythgoe, the curator of the Egyptian Department of the Museum, placed at his disposal Mr. A. C. Mace, one of the associate curators, Mr. Harry Burton, their expert photographic recorder, and Messrs. Hall and Hauser, draughtsmen to their expedition. At the same time, Mr. Lucas, director of the Chemical Department of the Egyptian Government, offered his aid, and all were soon at work. During the years that followed other workers were enrolled, including Dr. Alexander Scott and Dr. Derry. Altogether it took ten years to record the contents of the tomb and to preserve the objects so that they might be safely packed for transport to the National Museum at Cairo. Carter and his staff published three popular volumes on the tomb and its contents between 1923 and 1933; but much remains still to be published and this it is hoped will soon be done by the Cairo Museum authorities. Only a few weeks ago Prof. Georg Steindorff published, in the *Annales des Services des Antiquités de l'Égypte*, **38**, 641–667), a full account of the paintings on the walls of the tomb.

PERCY E. NEWBERRY.

Mr. E. R. Bolton

EDWARD RICHARDS BOLTON, who died on February 10, was born in Dublin in 1878, and was the only son of J. A. Bolton of Blackrock, Co. Dublin, of long Irish ancestry. He was at school at Bedford (Elstow) and studied chemistry at King's College, London, and in Fresenius's laboratory, Wiesbaden. On his return to England he was engaged for a short period in heavy chemical industry in Newcastle and in 1902 became chemist to the East India Products Oil Mills, Hammersmith, later Loders and Nucoline, Ltd. At these mills, Bolton carried out the first caustic refining of coco-nut oil in Great Britain. He became a director of the firm, having in the meantime started in analytical and consulting practice in Hammersmith.

Bolton quickly established a commanding position as analyst, consultant and technical adviser in the oil and fat and many food industries. In 1920, Technical Research Works Ltd. was founded, with premises in Milner Street, Sloane Square, Bolton being managing director, and transferring his analytical and consulting practice to the same address. 1920 is notable, too, in that it is the date of Bolton's patent for the continuous hydrogenation of unsaturated oils, fats and the like.

Much original work came from Bolton's fertile mind and clever hands: it was published mostly in the *Analyst*, from the year 1910, his last two papers (with K. A. Williams) being in 1938, both dealing with whale oil: his aptitude in devising apparatus and instruments is exemplified in the Bolton and Williams colorimeter. He also served on a number of research committees, particularly on analytical methods; at the time of his death he had just begun work with the "S.P.A." Sub-Committee on the determination of unpolymerisable matter in oils. Outstanding among his publications, there appeared in 1911 his book "Fatty Foods" (Bolton and Revis) a second edition of which, with the title "Oils, Fats and Fatty Foods" (Bolton) came in 1928.

Bolton was a well-known member of many societies; particular mention should be made of his services to the Society of Public Analysts and Other Analytical Chemists, of which he was honorary secretary from 1915 until 1925 and president during 1926–1927. For a period he was honorary treasurer of the Federal Council for Chemistry, and later was a member of the British Council for Chemistry of the Royal Society, a member of the delegacy of King's College, London, and a Royal Institution Visitor.

Seemingly in the full vigour of life, Bolton died, suddenly, after an illness from which he was thought to be recovering, leaving a widow and a host of friends to lament his loss. He was a remarkable and much-loved man, held in universal regard and affection alike by his staff, his colleagues and a wide circle of professional and business friends. His death is a serious loss to the profession of chemistry; yet throughout his life he did much to minimize this loss, for generosity in giving to others the fruits of his own gifted mind and of his wide experience was a notable characteristic of his ever-generous nature.

E. HINKS.

Prof. C. C. Okell

PROF. CHARLES CYRIL OKELL, who died on February 9, was educated at Douglas Grammar School, St. John's College, Cambridge, and St. Bartholomew's Hospital, and distinguished himself as a student. He became medically qualified during the Great War and served in the R.A.M.C. as lieutenant and captain in France, Palestine and Egypt, and was awarded the Military Cross when a regimental medical officer. Soon after the War he became bacteriologist to the Wellcome Physiological Research Laboratories at Beckenham, and left that institution to become professor of bacteriology at University College Hospital Medical School, London. He was for some time assistant editor of the *Journal of Pathology and Bacteriology* and at the time of his death was editor of the *Journal of Hygiene*.

Okell's active scientific life began at Beckenham. He was soon engaged in what has since become one of the main labours of the laboratory—the investigation of the problem of human immunization against diphtheria. He collaborated with Glenny in an important paper on the meaning of the Ramon flocculation test for diphtheria antitoxin. This was followed by a large volume of work on the problem of immunization against scarlet fever and a number of papers on the hæmolytic streptococcus and its toxin. He was also concerned in a comprehensive examination of the sugar reactions of the diphtheria bacillus and the development of an intracutaneous test for the virulence of diphtheria bacilli which made the routine testing of virulence much cheaper and more practical. He also published papers on the standardization of dysentery antitoxin, scarlet fever antitoxin and tuberculin, and was among the first to realize the importance of the application of statistical methods to biological assay.

Okell was part author of a paper which was perhaps the first to establish with statistical rigour the fact that 'B.C.G.' had some immunizing power against virulent tubercle bacilli. One of his last efforts at Beckenham was his attempt with Hindle to establish the possibility of vaccination against yellow fever, an exciting and dangerous piece of work, which he approached in the same spirit of detachment which characterized all his efforts.

On his appointment to the chair at University College Hospital Medical School, Okell delivered the Milroy Lectures in 1932, in which he summarized the fruit of his labours for many years on the hæmolytic streptococcus. He also made the discovery that simple operations such as tooth extractions are followed in a large number of cases by the appearance of streptococci in the blood of the patients, a most important observation which he would have followed up but for the rapid onset of the ailment which led to his retirement to Cambridge.

All Okell's work was done in collaboration with others. He loved the company of his fellows both in work and in leisure. He did not like working alone, and always discussed what he was doing with all and sundry. He was a great conversationalist, and was always worth listening to, not only when talking of his special subject, but also when ranging at large over literature, art and ethics. In none of the work in which he collaborated was his contribution the least important factor and he was generally the moving spirit. His work was never far removed from practical application. Interested though he was in fundamental problems, it could be seen that the motive of his work was primarily the benefit of the sick, particularly in the prevention of disease.

Okell was universally popular, and the gradual restriction of the field of his labours by his illness was a grief to all of his friends. He leaves a memory of care for others and single-hearted devotion to medicine which will endure.

J. W. TREVAN.

News and Views

New Fellows of the Royal Society

At the meeting of the Royal Society, held on March 16, the following were elected fellows of the Society:

G. S. Adair, assistant director of research in physiology, Cambridge, distinguished for his researches on the physical chemistry of proteins, particularly in connexion with hæmoglobin.

C. H. Andrewes, pathologist, National Institute for Medical Research, distinguished for his work on filtrable viruses and the bacteriophage, particularly in relation to the neutralization of viruses by antisera, and his studies on filtrable tumours.

M. Born, Tait professor of natural philosophy, University of Edinburgh, distinguished for his work in many branches of mathematical physics, and particularly for his contributions to quantum theory and its applications to physics and chemical physics.

A. J. Bradley, assistant director of research in crystallography, Cavendish Laboratory, Cambridge, distinguished for his methods of applying X-ray crystallography to elucidate the structure of metals, and particularly the gamma phase and order and disorder in alloys.

D. Brunt, professor of meteorology, Imperial College, London, distinguished for his contributions to analytical and dynamical meteorology, and particularly to the theory of the transfer of heat in the atmosphere.

F. A. E. Crew, Buchanan professor of animal genetics, University of Edinburgh, distinguished for his work on sex reversal in frogs and birds and on the genetics of many animals, especially *Drosophila* and budgerigars.

F. W. Edwards, Department of Entomology, British Museum, distinguished for his extensive researches on the order Diptera and for his studies on larval characters in relation to classification.

B. M. Jones, Mond professor of aeronautical engineering, Cambridge, distinguished for his researches in aeronautical science and for the elucidation of problems of design, such as the control at slow speeds and the determination of drag on full-scale structures.

G. W. C. Kaye, superintendent, Physics Department, National Physical Laboratory, distinguished for his pioneer work in X-ray measurements and for his studies on acoustics and physical constants: has rendered valuable service to the Radium Protection Committee and the National Radium Commission.

E. G. T. Liddell, fellow of Trinity College, Oxford, distinguished for his researches upon the physiology of muscle movement and posture in mammals, and upon their control during the normal and abnormal functioning of central nervous mechanisms.

E. J. Maskell, lecturer in plant physiology, Cambridge, distinguished for his work in the realm of plant physiology, especially in relation to problems of translocation.

I. Masson, vice-chancellor of the University of Sheffield, formerly professor of chemistry, University of Durham, distinguished for his researches in physical chemistry, particularly on the physical interaction of mixed gases and on new aspects of the chemistry of iodine.

C. E. K. Mees, vice-president of the Eastman Kodak Company, Rochester, N.Y., distinguished for his influence on the technology of photography, thereby assisting advance in many branches of science.

M. H. A. Newman, lecturer in mathematics, Cambridge, distinguished for his contributions to pure mathematics, particularly in the field of topology and group theory.

H. H. Read, professor of geology, Imperial College, London, distinguished for original work especially in connexion with the tectonic and petrological problems of the igneous and metamorphic rocks of northern Scotland.

Sir R. G. Stapledon, professor of agricultural botany and director of the Welsh Plant Breeding Station, Aberystwyth, distinguished as the founder of the Welsh Plant Breeding Station where, with a team of workers, he has undertaken studies of far-reaching importance on the improvement of pastures.

H. M. Turnbull, professor of morbid anatomy and director of the Bernhard Baron Institute of Pathology, London Hospital, distinguished for his work on morbid histology, particularly in relation to vascular disease, encephalitis, toxic hepatitis, diseases of bone, and normal and abnormal hæmopoiesis.

E. E. Turner, head of the Department of Organic Chemistry, Bedford College, London, distinguished for his contributions to the stereochemistry of organic compounds, especially in connexion with asymmetry in derivatives of diphenyl and with dissymmetry in the phenoxarsines.

V. B. Wigglesworth, reader in medical entomology, London School of Hygiene and Tropical Medicine, distinguished for his researches on insect physiology, especially in relation to digestion, tracheal respiration, excretion and possible endocrine secretion.

E. J. Williams, professor of physics, University of Wales, Aberystwyth, distinguished for his researches on the passage of electric particles through matter, and on individual collision processes, which have provided evidence for the existence of the heavy electron.

Dr. C. H. O'Donoghue

DR. C. H. O'DONOGHUE has been appointed to the chair of zoology in the University of Reading in succession to Prof. F. J. Cole (see NATURE of March 4, p. 368). After graduating with first-class honours in zoology and physiology from King's College, London, he was appointed lecturer in zoology at University College. He obtained the D.Sc. degree in 1912, was awarded a Beit Memorial Scholarship for research and spent six months studying at Freiburg under Prof. F. Doflein. In 1918 he went to Canada as professor of zoology in the University of Manitoba, and in 1923 acted as director of the Marine Biological Station at Nanaimo, Vancouver Island. For two terms he was visiting professor at Stanford University, California. He was also appointed by the Canadian Government for two years as head of a scientific expedition to Jasper Park in the Rocky Mountains. As a member of the Research Committee of the Biological Board of Canada, he helped to establish the Prince Rupert and Cultus Lake Stations. In 1927 he returned to Great Britain at the invitation of the late Prof. J. H. Ashworth, to become senior lecturer and later reader in zoology in the University of Edinburgh. In 1932 he was awarded the Neill Prize of the Royal Society of Edinburgh, and he was president of the Royal Physical Society of Edinburgh in 1933. His research covers a wide field, but is chiefly concerned with the taxonomy of the Bryozoa and Nudibranchia, and with vertebrate anatomy, physiology and embryology.

Prof. M. Leclerc du Sablon

CONGRATULATIONS are to be extended to Prof. Mathieu Leclerc du Sablon, who attains his eightieth birthday on March 25. Prof. Leclerc du Sablon is probably the last living member of the famous group of French botanists who at the end of the nineteenth century made very important contributions to the study of plant anatomy. From 1883 until 1890 he was working in Paris at the Ecole Normale Supérieure, and later at the Natural History Museum under Van Tieghem, his father-in-law and teacher. During this period he produced a series of important papers on various subjects in some of which are facts now taught to every student of elementary botany. His studies on the dehiscence mechanisms of anthers in the flowering plants and of the sporangia in the Archegoniatæ are especially noteworthy; he was the first to discover the mechanism of the annulus in the fern sporangium. Other important contributions were papers on the structure and physiology of tendrils, on the haustoria of parasitic flowering plants, on the development and comparative structure of the sporophytes of Liverworts, and on the development of the vascular system in young fern plants. In 1890 he was appointed professor of botany in the University of Toulouse, a post which he held for thirty years. His extensive knowledge of plants found expression in the "Cours de Botanique", a large text-book written in collaboration with Gaston Bonnier, his brother-in-law and former colleague. The first part of this work appeared in 1901; but it was not completed until 1933 when, after the death of Bonnier, the last part dealing with plant physiology was published. His activities have covered an exceptionally wide field, and his influence on the development of botany, especially in France, has been very considerable.

Archæological Studies in France

PROF. H. V. VALLOIS, professor in the Faculty of Medicine of the University of Toulouse, has been appointed professor of prehistoric anthropology in the Institut de Paléontologie humaine of the University of Paris. Prof. Vallois, who has long been recognized as standing in the front rank of authorities in France on human palæontology, has been in charge of the anthropological laboratory for practical studies of the Ecole des Hautes Etudes in Paris since 1937, and is senior editor of the periodical *L'Anthropologie*. He took up his duties at the Institut at the beginning of the current semester, and is delivering a course of lectures on the general principles of human palæontology and the prehominids. A course of lectures on prehistoric ethnography is also being delivered concurrently by the Abbé Breuil. A new department has been formed in the Ecole des Hautes Etudes for the study of geology with special reference to the origin of man. The first director of the department will be P. Teilhard de Chardin, who during his prolonged residence in the Far East has made numerous and important contributions to the study of the palæontology and pre-history of China and south-eastern Asia. It will be remembered that the first discovery of palæolithic implements in China was due to Teilhard de Chardin, while his studies of the fossil fauna of Choukoutien is the basis for the dating of Peking man. He contributes to the current issue of *L'Anthropologie* (**48**, 5–6; 1938) notes on the human palæontology of southern Asia, summarizing the results of his observations in Burma, Malaya, Java and Indo-China, when accompanying Dr. Hellmut de Terra on his recent geological and archæological survey in the Far East, supplementary to his investigations in India (see NATURE, **143**, 275; 1938).

German Activities in Central Europe

DURING the past fortnight, the State of Czechoslovakia has been forcibly broken up and a large part absorbed into the "Great German Reich" as the "Protectorate of Bohemia and Moravia". In the account of Czechoslovakia's contributions to science which appeared in NATURE of November 26, 1938, pp. 942–44, the hope was expressed that the scientific and cultural development of the Czechs would still be possible after their territory had been drastically curtailed by the Munich Agreement, and that they would continue to make contributions to the advancement of scientific knowledge and take a share in its application to the welfare of mankind. This hope was qualified by the anxiety then felt for those men of science and learning whom the impoverished State might not be able to support, and it is gratifying to know that, until recently, indeed

until the very end, the educational authorities succeeded in maintaining practically all the important research institutions and cultural associations remaining within the country. Scientific publications also continued to appear, and there was every reason to believe that the nation would, by hard labour, maintain its vigour and prosperity, and its men of science would be able to continue to achieve distinction and add to the sum of human knowledge by meritorious work in their respective fields. It is, perhaps, too early to foresee the consequences of the latest events in Central Europe. The new Protectorate is avowedly to have a measure of autonomy, though this is scarcely likely to go so far as to permit the free and open interchange of thought which has been banned in Germany for the past few years.

Tuberculosis in Wales

THE report is published of a Committee, consisting of Mr. Clement Davies and Dr. F. J. H. Coutts, appointed by Sir Kingsley Wood, when Minister of Health, in response to a request of the King Edward VII Welsh National Memorial Association for an inquiry into the anti-tuberculosis service in Wales and Monmouthshire (London: H.M. Stationery Office. 4*s*. 6*d*. net). The problem of tuberculosis is relatively more serious in Wales than in England, for the mortality rate has not declined so rapidly as, and exceeds, that of England. Excessive mortality in Wales occurs among young adults aged fifteen to twenty-five years and in the age group twenty-five to forty-five. In contrast with England, the rates at fifteen to twenty-five show little change since 1921 and the rate for females is distressingly high. Certain areas, notably Anglesey, Caernarvon and Merioneth, are especially afflicted with the disease. The report states, that for practical purposes, racial susceptibility as a factor in causing the high mortality may be ignored. Segregation in tuberculosis is one of the most effectual preventive measures against the spread of the disease, the need for additional bed accommodation if tuberculosis is to be adequately dealt with is stressed, and it is suggested that, with a widely scattered population in some Welsh areas, small local institutions of a simpler type might be a valuable adjunct to the more fully equipped hospitals. The Committee recommends the provision of additional laboratory accommodation, and suggest that the proposal to establish a village settlement in Wales should be explored.

IT is pointed out that after-care work has made little headway in Wales, and although the Committee does not recommend that the Association should undertake this work, the hope is expressed that local authorities will realize the importance of setting up effective care organizations. Treatment is only one aspect of tuberculosis work, and the importance of preventive work should be realized. Unfortunately, over large areas in Wales, preventive duties are neglected or are carried out imperfectly by local authorities, who do not appear fully to realize their responsibilities. In regard to housing, the report states that in rural areas, villages and small towns there are hundreds of houses that are unfit for habitation. The Committee also points out that there is scope for much improvement in the provision of milk and meals in schools, and authorities in Wales as a whole, with few exceptions, make little or no provision for midday meals. The Committee concludes by directing attention to the great disparity among local authorities in the standard of performance of public health services, and remarks that many of the authorities, owing to small population and inadequate resources of their area, are incapable of carrying out their public health duties properly. The Committee was impressed with the general efficiency of the Welsh National Memorial Association's work for the treatment of tuberculosis.

Launch of the R.R.S. *Research*

THE launching of the Admiralty non-magnetic ship, the R.R.S. *Research*, will take place at 6 p.m. on April 4 at the Noss Works, Dartmouth, of the builders Messrs. Philip and Son, Limited. The launching ceremony will be performed by Mrs. Spencer Jones, wife of the Astronomer Royal. The day and time of the launching have been chosen to coincide with the highest spring tides, as investigations proved that the *Research*, which is a 770-ton ship, would need all the water possible. The construction of a special vessel such as this, which is to be so far as possible non-magnetic, raises many problems. The question of the best substitutes for iron or steel in various components and fittings has required a good deal of investigation and experiment. The builders have shown a great interest in the work and have co-operated with the Admiralty to obtain the most satisfactory results. Lieut.-Commander D. H. Fryer, who has been appointed captain of the *Research*, was given special leave by the Admiralty to make a voyage to Australia in one of the grain ships in order to gain experience of sailing ships. He has recently completed the rigging of a scale water-line model of the *Research*, which will be on view at the reception to be given by Messrs. Philip and Son after the launching.

Recent Researches in Steel Metallurgy

IN a Friday evening discourse at the Royal Institution on March 17, Dr. W. H. Hatfield discussed what he described as the three principal aspects of steel research: (*a*) elucidation and improvement of the process of steel manufacture and manipulation; (*b*) the investigation of the properties of steel under variable conditions approximating to those of service; and (*c*) the exploration of the influence of added elements and of the effect of heat-treatment. Dr. Hatfield showed a colour film illustrating the electric and open-hearth steel processes, the casting of ingots and forging operations. Dr. Hatfield said that one of the most complex studies is that of the changing properties of steels with varying temperature, this

study not only including the properties of the steel at a particular temperature but also the degree of persistence of these properties at that temperature over long periods of time. In this connexion, details were given of a creep test carried out on a heat-resisting steel maintained under a load of 280 lb. per sq. inch for a period of 10,000 hours at 900° C. With reference to the production of permanent strain at normal temperatures, Dr. Hatfield instanced a test now in progress at the Brown-Firth Research Laboratories. The experiment consists of a strip of cold-worked austenitic steel placed in tension under a stress of 25 tons per square inch. The test was commenced in June 1929, and since that date the extension has been nil within the accuracy of measurement applied, that is, a sensitivity of 1/40,000 of an inch and a gauge length of 8 inches. In discussing the results achieved by the addition of alloying elements, Dr. Hatfield stated that, experimenting upon the basis of the rustless steel composition by modifying the chromium and nickel, and by adding other elements such as tungsten, molybdenum, cobalt or titanium, steels have been produced which maintain a reasonably protective film at temperatures even in excess of 1000° C., besides possessing a useful strength.

Palæolithic Man in Northern England

ALTHOUGH it is more than sixty years since the late Sir William Boyd Dawkins brought to light evidence of the presence of man during the Upper Palæolithic period in the north Midland region of England, it was not until Mr. A. Leslie Armstrong's investigations in the cave and other deposits of the area in a series of systematic researches, which began in 1921, that it became possible to establish a chronological succession in human occupation here in the course of the palæolothic age, and its relation to phases of the Ice Age. The results of these investigations were surveyed by Mr. Armstrong in his Wilde Lecture before the Manchester Literary and Philosophical Society on March 14. In dealing with the earlier evidence of occupation, he pointed out that until three years ago it had not been known that the range of Lower Palæolithic man extended to the northern Midlands, but intensive research directed to the contents of the glacial drift and old river terrace gravels of the Trent and its tributaries had provided evidence of his presence there in the form of hand-axes of flint and other artefacts, representing all the Lower Palæolithic cultures. Excavations in the Pin Hole Cave, Creswell, revealed three zones of occupation in Mousterian times, including two cold periods. Mr. Armstrong's Trent Valley researches indicate that the lower terrace gravels of the river approximate in time to the second Mousterian occupation of the cave, and that they were laid down during one, or possibly both, of the cold periods recorded in the cave. Rock shelters in the Creswell gorge and neighbouring valleys and habitation sites on the Lincolnshire cliff, covered by solifluxion deposits, indicate that man lived in these regions while events which mark the final glaciation of England were active in the east, west and north of the region; therefore human occupation of the north Midland area throughout palæolithic times can now be demonstrated.

Archæological Finds in the Nile Delta

AN archæological discovery described as "exceptionally important" is reported from the ancient city of Tanis in the Sharkia Province of the Nile Delta (*The Times*, March 20). Prof. Montet of Strasbourg, who has been engaged for some years in excavating on the site, on which both Mariette Pasha and Sir Flinders Petrie carried out archæological investigations, has discovered the first gold coffin to be found in Egypt since that of Tutankhamen, and a silver sarcophagus, the first example in that metal from Egypt. Tanis was the capital of Egypt between the Thirteenth and Eighteenth Dynasties; but the present find was made in excavating a series of funerary chambers of the tombs of kings of the Twenty-first and Twenty-second Dynasties (1100–950 B.C.), the capital of which was Tell Basta, the site of the modern Zagazig. Hitherto there has been no certain knowledge of the residence of these kings. The funerary chambers were empty, but a few days ago a narrow corridor was found leading to a wall which, when pierced, gave entry to an intact chamber of medium size, built of white limestone, and containing a gold sarcophagus. Within this sarcophagus was a second of silver, in which was a mummy. Inscriptions show that it is that of King Shishak. Two human skeletons still wearing ornaments were found on either side of the sarcophagus; and there were many jewels among the remains. In one corner of the tomb were funerary statuettes representing King Cumin, and in another corner a large vase, which has yet to be opened.

Libraries in Technical Institutions

A REPORT on libraries in technical institutions, which has been issued by a joint committee of the Association of Technical Institutions, the Association of Principals of Technical Institutions and the Association of Teachers in Technical Institutions, should be of considerable service to those responsible for providing and maintaining library services in technical colleges (Loughborough: Loughborough College, 1939). In addition to a clear analysis of the aims of such a library service, which should assist in the formulation of sound policy based on well-defined principles, it gives sufficient detail in regard to such matters as accommodation and planning to be of real service in the design of a new library or expansion of existing services. A feature of the report is the inclusion of plans and details not only of three distinct types of library design but also of a number of representative libraries. The basic recommendation of the report is that in every technical institution there should be at least one room of adequate size reserved solely as a library, containing an ample supply of books and periodicals kept thoroughly up to date and covering all departments of work carried out in the institution, and including also a good

collection of books of general interest. Wherever possible there should be a separate reading room, and in institutions doing advanced work small rooms should be provided for individual study and research. To secure full value from the library service, the library should be under the supervision of someone who has had a measure of special training and experience in library work. Alternative methods of recruitment to this end are discussed in the report. It is further recommended that properly qualified librarians employed in technical institutions should always be regarded as equal in status to members of the teaching staff and be paid on the Burnham Technical Scale—graduate or non-graduate—according to qualifications. An annual allocation for the provision of books, periodicals and binding of 3*s*. per student for the first 2,000 students and 2*s*. per student for each subsequent student is recommended.

Uniformity of Mycological Terms

THE Plant Pathology Committee of the British Mycological Society has addressed a circular letter to organizations in the British Isles which use the scientific names of fungi causing plant diseases. It is suggested that an agreement to use the names from a standard list of plant pathogens would be of great convenience, and would strengthen attempts to secure international uniformity. The proposed standard names are those included in the "List of Common Names of British Plant Diseases" (published for the Plant Pathology Committee of the British Mycological Society by the Cambridge University Press, 1934). Mycological nomenclature is greatly in need of any authoritative lead such as the one now proposed. It would, in fact, be very gratifying if the present modest suggestions should not only find immediate acceptance, but would also be extended later. A universally acceptable standard of naming for all fungi is urgently needed. The British Mycological Society has, moreover, always maintained a proper balance between all the branches of its study. It should, therefore, be accorded the full support of all mycologists of Great Britain. The Society has accepted its Committee's suggestions on nomenclature for all papers on pathogenic fungi, which will be published in its volumes of *Transactions*. Provision has been made for any desirable criticisms to be advanced against the actual list of names, and it is proposed to issue periodical revisions. Further particulars of the scheme may be obtained from the Secretary of the Plant Pathology Committee, Dr. G. C. Ainsworth, Experimental and Research Station, Cheshunt, Herts.

Horticulture of the Amaryllidaceæ

"HERBERTIA", the fifth year-book of the American Amaryllis Society (From the Editor, Mira Flores, Orlando, Florida, U.S.A., 1938) maintains a proper balance between needs of the grower, the scientific worker and the teacher, and attains a human interest in addition. The present volume is dedicated to Ernst H. Krelage (Holland), about whom an interesting autobiography appears. Classification of the Amaryllidaceæ is somewhat difficult, but a series of papers by Dr. H. P. Traub and J. C. Th. Uphof clarifies some obscurities and makes possible a tentative revision of the genus *Amaryllis*. Cytological studies have also been used by Walter S. Flory to re-establish the genus *Habranthus*. Experiments by W. M. James upon vernalizing seed of *Leucocoryne Ixioides* indicate the possibility of much faster production of flowering-size plants. I. W. Heaton reviews the possibilities of growing hybrid amaryllids with culture solutions instead of compost, and preliminary experiments suggest a useful and extremely economic method of culture. The section on harvesting, storage and forcing contains two mutually complementary papers by Dr. John Grainger (England), who describes the scientific principles underlying the production of early bloom, and by Prof. E. van Slogteren (Holland), who considers the practices for early forcing. "Herbertia" has also the usual descriptions of regional activities and garden culture. It is comprehensive, and succinct yet adequate. The policy of Dr. Hamilton P. Traub, its editor, presents the requisite blend of new and established knowledge which is essential for progress in modern horticulture.

A Doctors' Peace Manifesto

THE Balkan Medical Union (Athens, Belgrade, Bucarest and Istanbul) has addressed an appeal to medical men of all nations to take active measures to awaken public opinion on the horrors of war, and the terrible sufferings it inflicts upon the civil population of open towns. The Union believes that "only enlightened international opinion can make plain the imminence of the danger, and the uselessness, even for the victor, of war-time atrocities. The immutable truth that hate breeds only hate, and atrocity breeds vengeance, must be impressed on everyone". The Balkan Medical Union, founded in 1931, is essentially a scientific organization; but it also aims at bringing together the intellectuals of different countries so that they may know one another, and come to a mutual respect and understanding, whereby the misunderstandings that engender hate and disastrous struggles between nations may be dispelled.

The League of Nations

A REVISED edition of the "Aims, Methods and Activities of the League of Nations", which first appeared in 1935, has now been published (Geneva: League of Nations; London: George Allen and Unwin, Ltd., 1938. 2*s*.). Like the first edition it consists of four parts, the first including a historical account of international organization followed by a description of the nature, aims and methods of the League. The second part attempts to describe and assess impartially the achievements of the League, and although eminently readable and not overburdened with detail, gives a good comprehensive account of its work, which at the same time indicates some of the causes of its success and failure. The chief criticism that can be advanced of this section,

which occupies the greater part of the book, is that in attempting to be comprehensive it fails to evaluate sufficiently—the highly significant work of the League in the field of nutrition, for example, receives the barest mention. The work of the Permanent Court of International Justice and of the International Labour Organisation are dealt with in the third part; the final section of the book containing the text of the Covenant and extracts from the Statute of the Permanent Court and from the Constitution of the International Labour Organisation.

Hospitals in War Time

THE Minister of Health has issued to all hospital authorities and voluntary hospitals a memorandum explaining the main lines on which a scheme for a war-time hospital organization is being worked out for England and Wales (Emergency Medical Services Memorandum 2. H.M. Stationery Office. 6*d*. net). The basis of the emergency scheme is the division of hospitals into different classes according to the use which it is intended that they should serve, and almost all hospitals are included in some way. Room is to be made for the reception of casualties in one wing or block of most of the mental hospitals in the country, and a few mental hospitals are to be cleared of their ordinary patients. It is proposed to link up casualty hospitals to each other in the more vulnerable areas and to selected hospitals farther away. In order to increase the hospital accommodation, all hospitals would be asked to discharge all patients for whom institutional treatment is not essential, which it is estimated would probably free from 30 to 50 per cent of the existing hospital beds, and additional beds would be introduced into selected hospitals and institutions. Proposals for the organization of the medical and nursing staffs are also outlined.

Physical and Mental Welfare

THE Physical and Mental Welfare Society of New Zealand, Onehunga, N.Z., suggests that the centenary of New Zealand might be celebrated by the foundation of a memorial, and that this might take the form of an endowed scheme whereby the 'masses' might be kept in touch with scientific truths and views bearing upon the physical and mental welfare of the race. New Zealand was recognized as an independent Colony in 1841. Bearing on this subject, the Health Organisation of the League of Nations has issued reports on physical education and on nutrition (*Bull. Health Organisation*, 7, No. 4, 1938. Allen and Unwin, Museum Street, W.C.1. 2*s*. 6*d*.). The first report suggests a programme of laboratory research upon the effects of physical exercise, and on the relation between intellectual and physical development. The other report deals with principles to be observed in the study of diets and of the nutrition of a population, particularly as regards nutrition in the tropics.

Disposal of Offal

IN the Benjamin Ward Richardson Lecture recently delivered at the Royal Sanitary Institute, Mr. John Austin dealt with the hygienic treatment and disposal of offal and by-products in abattoirs. He said that two most important considerations govern the treatment of animal offal, namely, (1) the hygienic disposal of animal waste matter, and (2) its economic utilization. Suitable premises are needed to which all raw material can be brought from the slaughter-hall with the minimum amount of handling; they should be well lighted and ventilated and provided with an abundant supply of steam and hot and cold water. Mr. Austin then considered by-product work under the headings of blood, hides and skins, tripe, casings, edible fat and inedible offal, all of which require immediate treatment owing to the rapidity of decomposition after slaughter.

British Chemical Industry

A SURVEY of the achievements of British chemical industry in the last twenty-five years was given by Sir Gilbert T. Morgan in three Cantor Lectures to the Royal Society of Arts which have just been published. The field covered included inorganic chemicals, gases, nitrogen products, pigments, electrochemistry, metals, the utilization of coal, explosives, dyes, fermentation, plastics and drugs, and the lectures give a valuable survey of modern processes and the progress made in the period considered.

Centro Volpi Di Elettrologia

THE second number of this journal (English edition) mentions that amongst the first of its activities will be a convention for the development of 'experimentations' in view of industrial autarchy. In order to develop research work, which is the basis of industrial emancipation, Italian industrialists and the most competent scientific workers and technicians of the country will meet in Venice during October 26–28. They will examine the many sides of the problem of the improvement of existing laboratories, the creation of new ones and the co-operative work between them. The centre extends its welcome to all those who wish to attend the conventions. In the field of international relations the Centre is endeavouring to establish collaboration.

Safeguarding of Unpublished Research

SUCH attempts as were made by individuals or institutions to remove important papers to places of greater safety during the September crisis merely served to emphasize the impossibility of handling at short notice the quantity of material involved. The Research Co-ordination Committee accordingly decided to continue its investigation of the possibilities of micro-film technique. In view of recent international developments, the steps taken by the Research Co-ordination Committee to facilitate the reproduction and storage of documents are particularly timely. The process was described in NATURE of March 11, p. 393. Briefly, it consists in photographing documents of any kind, such as charts, pages of books, loose sheets, maps, etc., on to standard 35 mm. cine-film. Documents up to 17 in. × 24 in. can be dealt with (or larger ones in two or

more sections). The photographs are preserved in negative form on acetate safety film, which when tightly rolled is far more resistant to fire than any paper record. Working with quarto papers (10 in. × 8 in.), 1600 facsimiles can be obtained on 100 ft. of film. This micro-record occupies only one twentieth of the volume of the original. Full-size prints can be made from it at any time, or it can be read in a special projector, or thrown on a wall-screen for lectures. Preliminary arrangements are in hand for making micro-film records at the cost of one half-penny per quarto document, possibly less if a sufficient volume of material is handled. Further information may be obtained from the Hon. Secretary, Research Co-ordination Committee, 35 Gordon Square, London, W.C.2.

Old Science and Medicine

E. P. GOLDSCHMIDT AND CO., LTD., of 45 Old Bond Street, have recently issued three catalogues entitled respectively "Science and Medicine", "English Science and Medicine" and "Old Medical Books". The first catalogue contains entries of a complete set in thirteen volumes of Johann Peter Frank's "Complete System of Medical Polity", the first edition of De Kempelen's works on the talking machine, the first German edition of Kepler's "Steriometria" and numerous original papers by Pasteur, Scheel and others. In the catalogue on "English Science and Medicine" we note the rare third edition of Harvey's "De Motu Cordis", Gilbert's "De Magnete", several works by Robert Boyle, including that on "The Mechanical Origine of Production of divers particular Qualities . . . of Magnetical Qualities", the first work on electricity in English, the first edition of Sir Robert Dudley's "Arcano del Mare", one of the foremost English works on navigation and several modern works by Huxley, Galton, Rutherford, Banting and Best, among others. Among the most notable works in the catalogue of "Old Medical Books" are the first edition of John Vigo's treatise on surgery in black letter (1543), the first illustrated edition of Dioscorides (1543), Sir Theodore Turquet de Mayerne's work on arthritis (1676), and the first editions of Laennec's book on auscultation (1819) and Semmelweis's on puerperal fever (1861).

Eclipse of the Sun on April 19

AN annular eclipse of the sun, partly visible as a partial eclipse from the British Isles, occurs on April 19 next. The annular phase is visible in Alaska and the Arctic Ocean. At Greenwich, the eclipse begins at $17^h\ 29^m$, the greatest phase (0·36) being reached at $18^h\ 18^m$; sunset is at $19^h\ 2^m$, just before the eclipse ends. The position angle of first contact is 298° from the north point of the sun's image or 258° from the vertex. At Edinburgh the corresponding times are: beginning $17^h\ 17^m$; greatest phase (0·44) at $18^h\ 12^m$; ending at $19^h\ 3^m$. The above times are in Universal Time; add 1 h. to convert to Summer Time.

The Night Sky in April

THE moon is full on April 4 at $4{\cdot}3^h$ and new on April 19 at $16{\cdot}6^h$. The altitude of the full moon at transit at Greenwich on April $5^d\ 0^h\ 43^m$ is 27½°. Lunar conjunctions with the planets occur as follows: on April 10 with Mars; on April 16 with Venus; on April 17 with Jupiter; and on April 18 with Mercury. On April 22, Venus is in conjunction with Jupiter, the geocentric separation of the planets being only 0·4°. The two planets rise, however, less than one hour before the sun. Mercury is at inferior conjunction with the sun on April 3 and is therefore not visible. Saturn is in conjunction on April 11 and likewise rises and sets with the sun. Mars still remains a morning star, rising about 1½ h in mid-April. The only bright stars occulted during the month are ψ Ophiuchi (mag. 4·6) on April 8 at $2^h\ 2{\cdot}9^m$ (reappearance) as seen from Greenwich, and 26 Geminorum (mag. 5·1) on April 24 at $22^h\ 12{\cdot}1^m$ (disappearance). The Lyrid meteors, the radiant of which is near 104 Herculis, are due at their maximum between April 19 and 22, but in some years they are nearly absent. All the above times are given in universal time (U.T.). Summer Time begins on April 16.

Announcements

MR. J. E. MONTGOMREY has been appointed secretary of the Institution of Mechanical Engineers in succession to Brigadier-General Magnus Mowat, who has retired on account of ill-health. Mr. Montgomrey has been assistant secretary of the Institution since 1920.

THE Rockefeller Foundation has announced that during the next seven years it will grant a sum not exceeding £12,000 to the Imperial College of Science and Technology, South Kensington, for research on vitamins, sterols and related compounds under the direction of Prof. I. M. Heilbron.

AN Institute for Research in Aeronautical Medicine has recently been founded at Mount Fuji, Japan.

IN 1938 the number of deaths in France was 40,000 higher than the number of births, while in Italy the births exceeded the deaths by 424,000 and in Germany by 500,000.

THE University of Peiping, which was closed at an earlier stage of the Sino-Japanese War, has recently been reopened under the direction of Prof. Hisomu Nagat, formerly of the University of Formosa.

WE have received a part of the *Collection Scientifique* issued by the Institut Internationale de Coopération Intellectuelle (1938), entitled "Les déterminations physico-chimiques des poids moléculaires et atomiques des gaz", price 45 francs. The volume contains papers by Moles, Whytlaw-Gray, Cawood, Keesom and others, a long discussion and addenda.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 524.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Atomic Numbers of the So-called Transuranic Elements

WE have recently had the opportunity of obtaining a very strong preparation of the so-called transuranic elements, which are precipitated with platinum as sulphide in acid solution, from roughly 100 grams of uranium, after an irradiation with the neutrons of (^{7}Li + ^{2}H) carried out for us in the Cavendish High-Voltage Laboratory. A deuteron current of 100 μa. at 900 kv. was employed over a period of several hours, and the source of neutrons and the uranium were surrounded with a large amount of paraffin so that 'thermal' as well as fast neutrons were effective in the transformation.

The platinum precipitate, weighing less than 20 mgm., separated four days after the irradiation, was examined in a tube counter filled with xenon and alcohol vapour. The counter was fitted with a thin mica window at one end, and roughly 20,000 impulses per minute were recorded with the bare source 2 cm. from this window. When the β-particles were absorbed in graphite, roughly 425 impulses per minute remained. Absorption measurements using aluminium, copper and lead showed that, of these, more than a hundred impulses per minute were to be attributed to a quantum radiation in the ordinary X-ray region.

Further measurements were then made with thin foils of molybdenum (42), palladium (46), silver (47), cadmium (48), indium (49) and tin (50). In this range of elements, a large increase in transparency was observed between indium and tin; 30 mgm./cm.^{2} of tin reduced the counting rate by 36 per minute, whereas the same mass per square centimetre of any of the other elements produced a diminution which was almost twice as great. The simplest interpretation of this result is that a quantum radiation of wave-length between 0·443 A. and 0·424 A., the wave-lengths corresponding to the *K* absorption energies of indium and tin, is emitted by the source. According to the tables of natural X-radiations, the *K*α-radiations of iodine alone lie in this interval of wave-length. Again, then, the simplest supposition to make is that the element iodine is, in fact, one of the bodies present in the platinum precipitate, being formed from tellurium by β-transformation.

According to previous results[1], our precipitate contained only the radioactive bodies of half-value periods 66 hr. and 2½ hr. respectively. We therefore investigated chemically the suggestion that these bodies are in reality isotopes of tellurium and iodine. Strong confirmation was obtained from the fact that we were able to concentrate the activity of shorter period in a precipitate of silver iodide. On the basis of these results, it is very unlikely that any of the active products hitherto separated with platinum from irradiated uranium is a true transuranic element; rather must they all be regarded as originating in a similar process of nuclear fission to that in which the barium and lanthanum bodies have recently been shown to arise.

These results had been obtained when the *Physical Review* of February 15 was received in the laboratory. It is of interest to remark that Abelson[2] there records similar observations, made some time earlier than ours, and draws similar conclusions from his observations.

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March 9.

[1] Meitner, Hahn and Strassmann, *Z. Phys.*, **106**, 249 (1937).
[2] Abelson, *Phys. Rev.*, **55**, 418 (1939).

Transmutation of Uranium and Thorium by Neutrons

IT has been shown by Hahn and Strassmann[1] that uranium bombarded by slow neutrons forms a radioactive noble gas. We repeated their experiments, using the very strong neutron source of the Philips X-Ray Laboratory. About 500 cm.^{3} of a saturated solution of uranyl nitrate was irradiated. Air was bubbled through the liquid at a rate of 600 cm.^{3} per minute, then it passed through a tube filled with cotton-wool (length 15 cm.) and through a wash-bottle containing 40 cm.^{3} of water with a small amount of nitric acid and one drop of ammonia. After adding cæsium, rubidium, barium, strontium and lanthanum salts we obtained from the contents of this wash-bottle radioactive substances which could be precipitated together with cæsium, rubidium and barium.

Cæsium, precipitated after 15 minutes with antimony chloride dissolved in hydrochloric acid, showed periods of 10 minutes, 30 minutes and a longer period. Precipitating the cæsium from the solution 45 minutes after the irradiation had been finished, we obtained the 30-minute period only.

Rubidium was obtained by precipitation with a saturated solution of sodium bitartrate, dissolving the precipitate in dilute hydrochloric acid and adding perchloric acid. Occasionally the precipitation of the bitartrate was repeated in order to remove traces of cæsium. A period of 16 ± 2 minutes was found. As the decay curve has a shape quite different from that of the cæsium precipitate (neither a shorter nor a longer period was observed), this activity cannot be ascribed to small amounts of cæsium.

We looked for a short period in precipitates of the mixed alkali perchlorates prepared in a very short time. A period of 1–2 minutes was observed. We could not determine whether this activity is due to cæsium or rubidium.

Barium, precipitated as a sulphate or as a chromate, showed a period of 87 ± 1 minutes. After prolonged irradiation a much longer period was also observed. No short period was found when the isolation was carried out within a few minutes. By varying the time of irradiation it was shown that the 87-minute period is not produced by the alkali with a period of 1–2 minutes. From the fact mentioned above that the 30-minute period in cæsium is not accompanied by a longer period, it follows that the 87-minute activity does not arise from this cæsium either. Therefore we conclude that the 87-minute period is produced by the 10-minute activity of cæsium, which is in good agreement with the fact that in the cæsium precipitate a period of approximately this half-value was observed.

Strontium, which we freed from barium by treatment with chromate and precipitated as strontium sulphate, was found to be inactive after an irradiation of 100 minutes. Precipitates of mixed strontium and barium sulphates prepared in a very short time did not show any short-period activity.

In order to obtain a rough value for the half-life of xenon, we passed the air at a measured rate through two wash-bottles in succession. From the velocity of the air and a comparison of the activities of the cæsium obtained from the two bottles, we calculated the average period of xenon effective in producing radio-cæsium to be of the order of half a minute. From this experiment we were able to deduce the optimum air-flow.

From the presence of both cæsium and rubidium in the wash-bottle, it follows that xenon as well as krypton escape from the uranium solution bombarded with slow neutrons. This indicates that the uranium nucleus may break up in different ways. Radio-xenon gives rise to at least two kinds of active cæsium with periods of 10 minutes and 30 minutes. The cæsium with the 10-minute period forms radio-barium with a half-life of 87 minutes. The longer barium period is probably produced from the cæsium with a half-life of 30 minutes. We carefully compared the barium period of 87 minutes with that produced in barium by neutron capture and found them to be identical. Moreover, we compared the absorption curves of the beta-rays in aluminium as measured with two Geiger counters in coincidence arrangement. We found a perfect agreement.

Active krypton forms radio-rubidium with a period of 16 ± 2 minutes. Probably this period is due to the known radioactive rubidium isotope obtained from rubidium by neutron-capture. The half-life of the latter we found to be 17 ± 2 minutes. In this connexion, it may be mentioned that from uranium bombarded with neutrons Curie and Savitch[2] obtained precipitates of alkali salts showing a period of 18 minutes.

Based on the experiments described we suggest the following processes:

$$^{139}\mathrm{Xe} \xrightarrow{(\sim 0{\cdot}5\mathrm{m.})} {}^{139}\mathrm{Cs} \xrightarrow{10\mathrm{m.}} {}^{139}\mathrm{Ba} \xrightarrow{87\mathrm{m.}} {}^{139}\mathrm{La}\ (\mathrm{stable}).$$

$$\mathrm{Xe} \xrightarrow{(\sim 0{\cdot}5\mathrm{m.})} \mathrm{Cs} \xrightarrow{30\mathrm{m.}} \mathrm{Ba} \xrightarrow{(\mathrm{long})} \mathrm{La}$$

$$^{88}\mathrm{Kr} \longrightarrow {}^{88}\mathrm{Rb} \xrightarrow{17\mathrm{m.}} {}^{88}\mathrm{Sr}\ (\mathrm{stable}).$$

Corresponding experiments with a concentrated solution of thorium nitrate irradiated with the fast neutrons from a (Li + D) source also resulted in the production of a radioactive gas. Preliminary measurements showed that at least three periods occur in the alkali precipitate. The precipitate of strontium and barium sulphates was found to be radioactive too.

In order to check our observations, we collected the radioactive atoms from uranium on filter-paper in a way analogous to that described by Joliot[3]. The irradiations ranged from 15 minutes to 20 minutes. The filter was boiled in a solution containing cæsium, rubidium, barium, strontium and lanthanum salts. The alkali perchlorates precipitated from this solution showed a short period of 1–2 minutes and at least one longer period. Barium chromate obtained from the solution showed periods of 12 ± 2 minutes and 87 minutes. The strontium proved to be active too.

We succeeded in measuring the 1–2 minute period more easily without a chemical separation by covering the filter paper with a layer of 4 mm. of aluminium.

It is interesting to observe that the 12 ± 2 minute period in barium was not obtained from the gas. This suggests that it may be formed together with krypton, unless it arises from a very short-lived xenon period or from cæsium formed directly from uranium.

An attempt to activate uranium with the gamma-rays from lithium bombarded by protons gave no result. A search for electrons having an energy exceeding 10 Mev. during the irradiation of uranium with slow neutrons using two Geiger counters in coincidence arrangement was unsuccessful.

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March 10.

[1] Hahn and Strassmann, *Naturwiss.*, **27**, 89 (1939).
[2] Curie and Savitch, *C.R.*, **208**, 343 (1939).
[3] Joliot, *C.R.*, **208**, 341 (1939).

Chemical Separation of Isomeric ^{80}Br Atoms

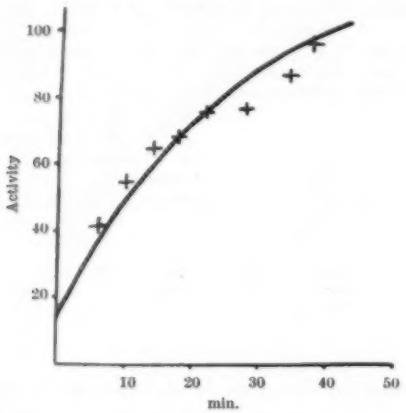
FOR rather more than a year, we have been studying the concentration of radiobromine by modifications of the method of Szilard and Chalmers[1], and have been using concentrates to follow the kinetics of exchange reactions between radiobromine ions and alkyl bromides. In the course of this work, we have encountered a number of puzzling phenomena which are now completely explained by the remarkable discovery made by Segrè, Halford and Seaborg[2] and DeVault and Libby[3] that the isomer of ^{80}Br with a half-life of 4·5 hours decays by a γ-ray change to an isomeric ^{80}Br which emits β-rays with a half-life of 18 minutes. The recoil from the soft γ-ray emitted by the parent nucleus (and its internal conversion) has been found sufficient to break a chemical bond in the BrO_3 anion or to activate the C–Br bond in *tert*butyl bromide and facilitate the hydrolysis of this compound. These reactions have been used to separate the isobaric 18-min. product from its parent 4·5-hour isomer with which it was previously in radioactive equilibrium. The β-ray activity of the daughter isotope in the reaction product was found to decay with a half-life of 18 min., whilst the activity of the residual bromine in the original reaction *increased* with time as the equilibrium concentration of the 18-min. isomer was restored by decay of the parent.

The purpose of this note is to record some of our observations which confirm the results of the workers at Berkeley. We have found that the addition of a few per cent of aniline (other nitrogenous organic bases behave in a similar manner) to an organic bromide before irradiation with slow neutrons gives a large increase in the amount of radiobromine which can be extracted afterwards by water or aqueous acids. In this case it is the capture γ-rays which disrupt or activate the C–Br bond and facilitate the reaction

$$RBr + PhNH_2 = PhNH_2R^+ + Br^-.$$

This reaction can also give a large separation of the ^{80}Br isomers, as the following experiment shows.

Pure ethylene dibromide was irradiated with slow neutrons (from 200 mgm. radium sulphate plus beryllium) for 15 hours. Five per cent of aniline was then added and the mixture shaken with water at intervals until five hours had elapsed. By this time all the 18 min. isomer originally present would have decayed. After a final wash, the β-ray activity of the specimen was followed for 45 min., with the result shown in the accompanying graph. The initial



activity found was largely due to ^{82}Br with a half-life of 36 hours; this was measured after the shorter lived products had completely decayed, and the data in the graph are corrected for this activity. If the separation of the ^{80}Br isomers were complete, the initial activity would be zero. The full line in the figure represents the calculated curve for 90 per cent separation: it will be seen that the reaction of salt formation with aniline gives a separation of this order of magnitude. The activity in the aqueous extract was found to decay with a half-life of 18 min.

In our kinetic studies alkyl bromides, notably *n*-butyl bromide, were allowed to interact with radioactive bromine ions in a solvent consisting of 90 per cent acetone and 10 per cent water. At the end of the reaction the alkyl bromide was separated by dropping a portion of the mixture into water and extracting with benzene. When working with bromine of which the activity was mainly that due to the 4·5 hour period, we have repeatedly found that the β-ray activity of the benzene solution increased 20 per cent or more during the first hour after washing with water, whilst a reference specimen of the acetone solution decayed normally. This effect was not observed during the study of slow reactions in which the activity was measured after two to three days and was entirely due to ^{82}Br (36 hours). Hence the hydrolysis of *n*-butyl bromide under the conditions of our experiments also gives a considerable separation of the isomeric ^{80}Br atoms.

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[1] Szilard and Chalmers, NATURE, 134, 462 (1934).
[2] Segrè, Halford and Seaborg, *Phys. Rev.*, 55, 321 (1939).
[3] DeVault and Libby, *Phys. Rev.*, 55, 322 (1939).

Structure of Meteorites

Prof. E. A. Owen and R. W. Williams[1] have recently advanced a theory in which they account for the Widmanstätten figures in meteorites on the basis of their X-ray studies of iron-nickel alloys, natural and artificial. Their conclusions have been criticized by Prof. S. W. J. Smith and J. Young[2] on the grounds that only the surface of the meteorites is heated by passage through the earth's atmosphere. This criticism must not be allowed to detract from the merits of the experimental evidence given by Owen and Williams, which to a large extent receives confirmation from an investigation I have recently carried out with Mr. Goldschmidt.

X-ray powder photographs show that the iron-rich end of the nickel-iron equilibrium diagram must be completely redrawn. The areas of single phase and two-phase equilibria shown in the figure are based on the results of long periods of heat-treatment, and cannot be attained by cooling at the usual rates. Some idea of the times required even under the most favourable conditions is given by the time-scale attached to the diagram. Shorter times of annealing give entirely different results. There is not space here to give the evidence on which this diagram is based, or to explain its details. The purpose of this communication is to show how it affects the problem of the meteorites.

The new diagram confirms Owen's conclusion that suitable heat-treatment leads to the production of a two-phase structure in certain alloys. A typical meteoritic structure, which consists of a mixture of kamacite (body-centred cubic with 6 per cent of nickel) and tænite (face-centred cubic with about 26 per cent of nickel), is the equilibrium state at temperatures between 350° and 580° C. The existence of plessite in some meteorites may perhaps be explained as due to sudden cooling from above 580° C., leading to a deformed body-centred cubic structure produced by a sudden breakdown of the face-centred cubic form, though other explanations are possible.

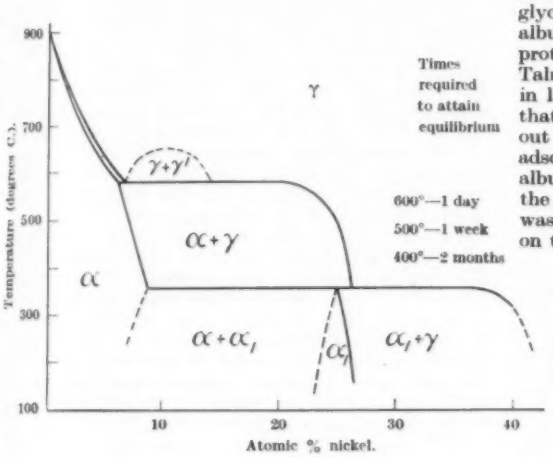
Up to this point Owen's results are confirmed. There are, however, two important features of his theory which require modification.

(1) It must be concluded from the criticisms advanced by Smith and Young that the heat-treatment by which the meteorites received their characteristic structure occurred before they reached the earth and was not substantially modified by passage through the earth's atmosphere.

(2) Our diagram indicates that a further transformation not mentioned by Owen occurs at 350° C. or thereabouts. The typical meteoritic structure is

only in equilibrium between 350° and 580° C., and not below 350° C. Such meteorites must therefore have received their heat-treatment above 350° C. They must have cooled too quickly for equilibrium conditions to be followed down to terrestrial temperatures; at such temperatures they are too sluggish for further changes to take place.

The $\alpha + \gamma$ structure formed in the temperature range between 350° and 580° C. requires a time of the order of months to break down when the temperature drops below 350° C. Breakdown takes place, for example, when the cooling rate is about 1° C. per day, not for more rapid rates. The transformation to $\alpha + \gamma$ at 580° C. is also slow, but not so slow as the lower transformation. At a cooling rate of 100° C. per day this reaction is just beginning to go. The conclusion seems to be that the meteorites have cooled at some intermediate rate, slow enough to permit the 580° C. change to take place, but too fast for the 350° C. transformation.



Before deciding when and where this cooling took place, it is important to consider another fact. A single cooling, though satisfactory for the production of small submicroscopic crystals such as are found in our experiments, would be totally inadequate to give the large crystals found in meteorites. It must be concluded that the process has been repeated thousands if not millions of times.

Is it possible that some meteorites were bodies in cometary orbits, and they have been heat-treated by approaching the sun and cooled by moving into the outer parts of the solar system? The cooling rate seems quite reasonable, the short time in which the meteor is near the sun being quite inadequate for the attainment of equilibrium below 350° C., though it may well be sufficient to promote crystal growth at higher temperatures. The meteorite is subjected to fresh heat-treatment every time it reaches the neighbourhood of the sun, but the most effective part of this treatment is that which takes place in the $\alpha + \gamma$ range; as the crystals grow, it becomes increasingly difficult for the 350° C. transformation to take effect.

This explanation is applicable to meteorites in which the tænite phase has a composition of about 25 per cent nickel. For example, the San Cristobal meteorite with 26·3 per cent of nickel is mostly tænite with patches of plessite. The structure of other meteorites in which the tænite contains more nickel must have been produced in other ways. Prof. S. W. J. Smith and J. Young have recently described such a case[3].

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[1] NATURE, 142, 999 (1938).
[2] NATURE, 142, 1162 (1938).
[3] NATURE, 143, 384 (1939).

'Intraglobular' Reactions and the Cyclol Structure of Proteins

IN order to explain the effect of a protein on a certain condensation reaction, Talmud[1] has proposed a hypothesis for 'intraglobular' reactions, based upon Wrinch's well-known theory[2] of protein structure. As an example, he showed that a considerable portion of 2-5-dioxopiperazin formed by condensation of glycine ethyl ester[3] in an aqueous solution of egg albumin remains in solution associated with the protein, in excess of the normal solubility limit. Talmud suggests that the reaction has taken place in large part within the hollow cyclol globules, and that the reaction product is prevented from diffusing out owing to its molecular size. By independent adsorption experiments (on heat-denatured egg albumin at 0°) Talmud believes he has shown that the amount of dioxopiperazin remaining in solution was in excess of the amounts that could be adsorbed on the surfaces of the globular protein molecules.

We have measured the sedimentation constant and the diffusion constant of the egg albumin - dioxopiperazin complex in order to get an estimate of its size and shape. The sedimentation constant was measured both in the water - alcohol - dioxopiperazin medium formed by the reaction, and in a solution dialysed against 0·2 *m* sodium chloride. Within experimental errors, we always obtained the same value. The average was 3·62 (sedimentation constants are given in units of 10^{-13}; diffusion constants in units of 10^{-7} throughout), which is a little higher than for ordinary egg albumin[4] (3·55). This fact possibly indicates that the glycine ethyl ester has replaced some of the water bound to the molecule. The diffusion constant was found to be 6·6, as an average of three experiments. For ordinary egg albumin the value[4] is 7·76. The reduction of the diffusion constant indicates an increase of the volume of the particle, probably by interaction between the glycine ester and the free amino or carboxyl groups on the surface of the protein molecule. According to Talmud's theory, there should be no change in the volume of the complex particle, because the dioxopiperazin molecules are retained inside the globule after the 'intraglobular' reaction.

Talmud found precipitation on prolonged dialysis against pure water, probably due to denaturation. We found no difficulty in dialysing against salt solutions. When dialysing against water, a small precipitate formed, but most of the complex remained in solution and showed the same sedimentation constant as before dialysis.

Our experiments seem to show that the egg albumin - dioxopiperazin complex can be considered as a chemical compound, in which glycine residues, $-HN.CH_2.COOH$ or $-OC.CH_2.NH_2$, are bound to the hydroxyl groups or the free amino groups of the

protein. One might also suppose that one glycine molecule might be bound to another one already combined with the protein. It is not clear why such reactions should be slower than the formation of dioxopiperazin from glycine ethyl ester. The 'intra-globular' accumulation of dioxopiperazin molecules should have given a higher sedimentation constant (calculated from Talmud's figures, $s = 4{\cdot}02$) than we found. Talmud assumed that the whole volume of the egg albumin molecule could be filled with dioxo-piperazin molecules. This disregards the volume taken up by the protein itself. The space available for non-protein materials inside the presumed globule must be much less than the total volume of the protein globule. The low value found for the diffusion constant probably must be explained by outside bound groups. If one presumes the egg albumin molecule to be spherical (which is very nearly true) and the bound groups to be placed symmetrically around it, the reduction of the diffusion constant from 7·76 to 6·6 means an increase of about 60 per cent in the volume.

It is therefore obvious that Talmud's experiments cannot be taken as an experimental proof of Wrinch's hypothesis, although they may be of interest for the understanding of protein structure and protein synthesis.

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[1] Talmud, D. L., *Compt. rend. Acad. Sci. U.R.S.S.*, **20**, 153 (1938). *Brit. Chem. and Physiol. Abstr.*, A, II, 42 (1939), and private communications.
[2] Wrinch, D. M., *Proc. Roy. Soc.*, A, **160**, 59; A, **161**, 505 (1937); *Trans. Far. Soc.*, **33**, 1368 (1937); and several communications in NATURE.
[3] Fischer, E., *Ber.*, **34**, 433, 2868 (1901).
[4] Svedberg, T., NATURE, **139**, 1051 (1937); *Ind. and Eng. Chem.*, Anal Ed., **10**, 113 (1938).

Spontaneous Coagulation of Rubber Latex

So early as 1913, Whitby advanced the view that spontaneous coagulation in rubber latex takes place before decomposition processes begin[1]. Arguments against this view have since been advanced by several investigators, and the opinion at present generally held is that the coagulation of fresh latex is caused by formation of acid from the bacterial decomposition of the serum constituents.

Recent investigations made on latex of *Hevea brasiliensis* have provided confirmation of the view held by Whitby. Experiments were conducted throughout on latex obtained immediately after collection from the trees, which had been tapped three or four hours previously. The formation of ions from decomposition of latex was followed by conductivity measurements. The conductivity of latex did not change until coagulation was complete. This occurred 6–11 hours after collection of the latex, varying from sample to sample. The resistance of the conductivity cell increased after gel formation due to contact resistance on the electrodes.

The *p*H after coagulation (measured by Lyphan indicator strip) was only 0·2 lower than the average original figure of about 6·4. Decreasing the *p*H below 6 by the addition of phthalate-KOH buffer solutions had no effect on the rate of coagulation of the samples. After coagulation decomposition of latex constituents proceeds; but this bears no relation to the process of coagulation which is already complete.

Further support of Whitby's view was provided when strong antiseptics preventing bacterial decomposition were added to fresh latex without preventing spontaneous coagulation. The addition of 0·3 and 0·4 per cent sodium pentachlorphenate had no influence on the behaviour of latex as described. No decomposition nor any change in the *p*H value of 7 could be found in coagulated samples which were measured over a period of 3–6 weeks.

The exact nature of this process of coagulation is not known; enzymatic action on proteins may, however, be put forward as an explanation.

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[1] *Koll. Z.*, **12**, 151 (1913).

Demonstration of the Participation of Free Radicals in the Rearrangement of Benzyl Phenyl Ether

IT has been shown previously[1] that when benzyl phenyl ether is heated in quinoline at about 250°, the normal rearrangement of the ether to *o*- and *p*-benzyl phenols is accompanied by the formation of benzyl-quinolines and of toluene. It is now found that hydroxyphenyl quinolines are also products of this reaction, and that it is possible, by a careful control of the experimental conditions, to increase very considerably the yields of benzylquinolines and hydroxyphenyl quinolines at the expense of the normal products of the rearrangement.

This new evidence strongly supports the contention that the preliminary phase of the reaction is a dissociation of benzyl phenyl ether into benzyl and phenoxy groups. As both these groupings are found to attack the same positions in the quinoline nucleus, it seems unlikely that they react as ions having opposite charges. This result is consistent only with the view that the reactive centres of both groups are in the same electronic state[2]. This can only occur if the ether dissociates into free radicals.

This conclusion does not require the assumption of any special reaction of free radicals, except their ability to replace the hydrogen of the aromatic nucleus; it is based on experimental evidence which is considered to afford an independent and reasonably satisfactory demonstration of the existence of free radicals of short life in solution.

An extension of this investigation to other re-arrangements is now in progress.

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[1] Hickinbottom, NATURE, **142**, 830 (1938).
[2] Bradley and Robinson, *J. Chem. Soc.*, 1254 (1932).

A Fluoride with Pyrochlore Structure

THE formula of the rare mineral ralstonite is usually written $(Na_2,Mg)F_2.3Al(F,OH)_3.2H_2O$. This implies a replacement of Na_2 by Mg. X-ray investigation of this mineral shows that it belongs to the space-group O^{h7} — *Fd3m* and that the edge of the unit cube has a length of 9·87 A. By recalculation from the best available analysis (Penfield and Harper, 1886), it can be shown that a unit cube contains on the average 48 (F,OH), 16 (Al,Mg), 2·7 Na and 7 H_2O. The structure is similar to that

of the pyrochlore group (type $E\,8_1$) for which the formula $X_2Z_2(O,OH,F)_7$ has been written. In the case of ralstonite the X position (16c) is only partly filled by 2·7 Na. Water partly fills the 8*b* position which is occupied by O, OH or F in minerals of the pyrochlore group.

Ralstonite may be dehydrated without destruction of the crystal lattice.

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A Visual Phenomenon

MR. DARTNALL[1] has recently described an interesting visual phenomenon which, as has been pointed out by Mr. Wright[2], is connected with the after-images of different colours possessing different rates of development. A visual phenomenon possibly connected with this differential rate of development came to my notice some time ago, and no doubt must have been observed by others as well. A stroboscopic disk painted in black and white sectors is run under illumination from an (ordinary) Osram neon lamp connected to A.C. supply (60 cycles). At speeds such that the pattern is not stationary but somewhat shifting, the white sectors appear to be distinctly coloured (rainbow type)—one edge pink and the other green. The same effect is seen, though not so clearly, when the neon lamp is replaced by an ordinary incandescent lamp, provided the illumination is not high.

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[1] NATURE, 142, 1000 (1938).
[2] NATURE, 142, 1136 (1938).

Changes in the Water-Content of Organs and Tissues as a Result of Stimulation by Œstradiol

APART from its specific property of stimulating proliferation in the reproductive tract and in certain other tissues of the body, œstrogenic hormone has the more general effect of causing water and salt retention. This was clearly demonstrated in the follicular phase of the menstrual cycle in the pig-tailed monkey[1] and baboons[2], and in rhesus monkeys which had been injected with œstrogenic hormone[2,3]. In these animals, water-retention is most obviously related to swelling of the sexual skin, and it may be associated with a marked shift of body water (as shown, for example, by changes in erythrocyte concentration)[3,4]. Study of the renal excretion of electrolytes has shown that water-retention also occurs in male dogs after treatment with œstrogenic substances[5], while more recently Astwood[6] has reported that the water-content of the uterus of the rat undergoes a transient rise which reaches its peak six hours after a single injection of œstrogenic hormone, returning to normal about twelve hours after the injection.

A further study of immature rats shows that œstrogenic stimulation causes a rapid change in water-content not only in the reproductive tract but also in most organs and tissues.

Estimations of the water-content of nine selected tissues were made at six-hourly intervals after the subcutaneous injection of 0·1 γ of œstradiol in 0·1 c.c. of oil. Water-content was determined by comparing the weight of the fresh tissues with their weight after desiccation in an oven at 110° C. Ten rats were used for each six-hourly reading.

The tissues were divided by their responses into two clearly defined groups, the first being made up of the skin, uterus and vagina, and the second of striated muscle, heart, pancreas, brain and gut.

Water-content in the first group of tissues reached a high level by the end of the first six hours. It then fell (in the case of the skin and vagina to a lower level than normal) and remained down until the twenty-fourth hour, when it rose again to remain at a high level until the sixty-sixth hour. By the seventy-second hour, it had either resumed its normal level or fallen below it.

The changes in the second group of tissues (striated muscle, heart, brain, pancreas, gut) were in a sense reciprocal to those in the first. In the first twelve hours after injection, water-content either fell or remained unaffected. It rose to a level above normal during the period (twelfth to thirtieth hours) in which the water-content of the first group of tissues was low. It then decreased and reached a minimum about the middle of the second and more prolonged period in which the water-content of the reproductive tissues and skin was high. At the end of this period it underwent a sharp transient rise, before reaching its normal level, or a lower level than normal, at the seventy-second hour. Corresponding observations have been made on normal and castrated male rats injected with œstradiol, as well as on normal mice in œstrus and in dicestrus, the latter observations showing that cyclical changes normally occur in the water-content of the tissues referred to above.

These findings show that œstrogenic stimulation causes a much more widely spread change in the body than has been suspected hitherto. In the case of the skin, the total amount of water-shift amounts to almost one per cent of the total body-weight (estimation based on tables provided by Donaldson[7]). A change of this kind and magnitude cannot be regarded as secondary to changes in water-concentration occurring primarily in the reproductive tract, and presumably, therefore, œstrogenic stimulation has a direct effect on the water-content of many, if not of all, tissues.

In so far as œstrogenic substances lead to water- and salt-retention, they behave like the chemically related substances progesterone and testosterone, as well as like desoxycorticosterone. This general property of the sterol hormones does not, however, imply a similarity of action. Thus nitrogen-retention is associated with the water- and salt-retention stimulated by œstrogenic and androgenic substances, whereas it does not occur as a result of the action of progesterone and desoxycorticosterone[8]. Furthermore, it has been shown that the excretion of water which has accumulated in the sexual skin of monkeys under the influence of œstrogenic stimulation cannot be prevented by the administration of progesterone, testosterone, or cortin[3]. Preliminary observations on the effect of these substances on female and male rats, made in the course of the present study, suggest

that, while changes in water-content occur in all the tissues studied (the changes being especially pronounced in the skin), their character and time-relations are not the same as those which occur after œstrogenic stimulation.

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[1] Krohn, P. L., and Zuckerman, S., *J. Physiol.*, **88**, 369 (1937).
[2] Fisher, R. B., and Zuckerman, S., *J. Physiol.*, **89**, 15P. (*Proc.*, Dec. 12, 1936).
[3] Guthkelch, A. N., and Zuckerman, S., *J. Physiol.*, **91**, 269 (1937).
[4] Clarke, R. W., *Amer. J. Physiol.*, **123**, 39 (1938).
[5] Thorne, G. W., and Engel, L. L., *J. Exp. Med.*, **68**, 299 (1938).
[6] Astwood, E. B., *Endocrinology*, **21**, 25 (1938).
[7] Donaldson, H. H., "The Rat" (Philadelphia, 1924).
[8] Zuckerman, S., *J. Physiol.*, **94**, 3P. (1938).

A Humoral Transmission of Muscular Contraction in the Presence of Veratrine

THE hind limbs of a Hungarian frog are perfused with veratrine 1/50,000 in Ringer's solution. The liquid collected from the vein perfuses a second, similar Trendelenburg's preparation. Direct tetanic stimulation of the hind limbs of the first frog is followed, after a latent period of about 10 minutes, by an irregular contraction of the perfused muscles of the second frog. It is thus possible to demonstrate a humoral transmission of the contraction in the presence of veratrine.

This effect is not due to acetylcholine, because (1) veratrine has no anticholinesterase action (Bacq and Brown), and (2) the transmission is still demonstrable in the presence of curare.

We think that the substance responsible for the effect is the K ion, because (1) veratrine, even in 1×10^{-6} solution, greatly sensitizes frog's muscle to the action of K^+, and (2) the addition of a small amount of potassium chloride (0·5 mgm.) to an inactive perfusate (2·5 c.c.), collected in absence of stimulation, reproduces perfectly the action of a 'stimulation' perfusate. This quantity of potassium can actually be liberated during a tetanic contraction.

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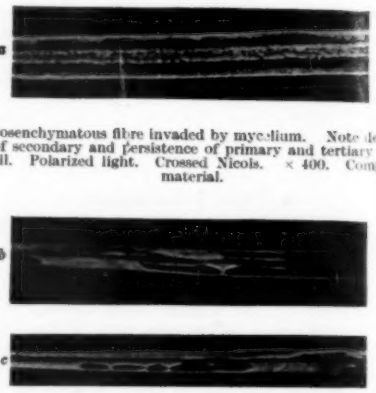
Role of Fungi and Actinomycetes in the Decomposition of Cellulose

WAKSMAN[1] has recently demonstrated, by cultural methods, the important role of fungi and actinomycetes in the breakdown of plant tissues in composts and dunghills. The details of the process, however, were not directly observed. I have previously[2,3] described methods, involving the use of polarized light, for the direct microscopical observation of the cytoclastic process in the cæcum and rumen of herbivora. These methods have since been applied to the study of the decomposition of vegetable materials in animal fæces, composts and dunghills. The role of Fungi and Actinomycetes in the breakdown of cellulose thereby immediately became conspicuous. Disintegration of the cell-wall constituents was directly evidenced by loss of double-refraction and by disappearance of microchemical reaction in the affected structures.

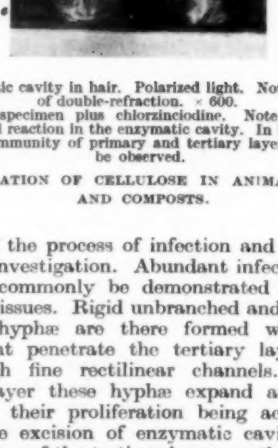
The characteristic features which attend the excision of enzymatic cavities by fungi have been described by Bailey[4]; so that it is possible readily to distinguish the changes taking place from those produced by bacteria.



(*a*) Prosenchymatous fibre invaded by mycelium. Note destruction of secondary and persistence of primary and tertiary layers of wall. Polarized light. Crossed Nicols. × 400. Composted material.

(*b*) Plant hair, late phase of attack. Note formation of conical and biconical enzymatic cavities (cf. Bailey[4]). On right, complete dissolution of secondary wall. Primary wall still intact. Tertiary wall in process of disintegration. Crossed Nicols. × 400. Horse faeces *in vitro*. 2 months.

(*c*) Another portion of same hair. Earlier phase of attack. Excision of channels by fungus filaments. The advancing tip of a hypha can be clearly seen slightly right of centre. Crossed Nicols. × 400. Horse faeces *in vitro*. 2 months.



(*d*) Enzymatic cavity in hair. Polarized light. Note entire loss of double-refraction. × 600.

(*e*) Identical specimen plus chlorzinciodine. Note absence of microchemical reaction in the enzymatic cavity. In both *d* and *e* the relative immunity of primary and tertiary layers can again be observed.

DISINTEGRATION OF CELLULOSE IN ANIMAL FÆCES AND COMPOSTS.

Details of the process of infection and attack are now under investigation. Abundant infection of the lumen can commonly be demonstrated in prosenchymatous tissues. Rigid unbranched and extremely attenuated hyphæ are there formed which from point-to-point penetrate the tertiary layer of the wall through fine rectilinear channels. In the secondary layer these hyphæ expand and branch repeatedly; their proliferation being accompanied by an active excision of enzymatic cavities. The disorganization of the tertiary layer, on the contrary, is delayed until a later phase in the process; whilst the primary layer may in some cases entirely resist destruction. This resistance is due to the impregnation of the cellulose substratum by encrusting

substances the presence of which can be demonstrated by extraction with solvents and by microchemical reactions. In this way it can be shown that the cytoclastic process may be highly selective; and that the changes occurring, for example in composts, may bear reference to the balance of cell-wall constituents in the materials employed.

The accompanying photomicrographs illustrate some of the salient features in the changes described above.

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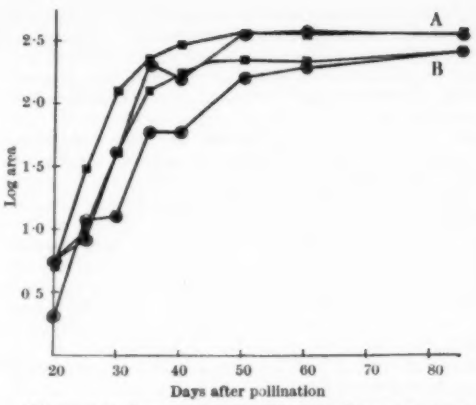
[1] Waksman, S. A., Umbreit, W. W., and Cordon, T. C., "Thermophilic Actinomycetes and Fungi in Soils and Composts", *Soil Science*, **47**, 37 (1939).
[2] Baker, F., and Martin, R., "Disintegration of Cell-Wall Substances in the Gastro-Intestinal Tract of Herbivora" (with references to previous publications, 1931–1937), NATURE, **141**, 877 (1938).
[3] Baker, F., and Martin, R., "Studies in the Microbiology of the Caecum of the Horse", *Z. Bakt.*, Abt. II, **99** (1939).
[4] Bailey, I. W., and Vestal, M. R., "The Significance of Certain Wood-destroying Fungi in the Enzymatic Hydrolysis of Cellulose", *J. Arnold Arboretum*, **18**, 196 (1937).

Hybrid Vigour in the Tomato

THE vigorous growth of hybrids between closely related varieties has been widely observed, and for several years the phenomenon has received the attention of geneticists. Investigations have also been made on the physiology of hybrid vigour (heterosis). Ashby[1] and Luckwill[2] have shown that in the tomato heterosis is manifested at an early stage in the life-history, between fertilization and seed ripening, so that the ripe hybrid seed, resulting from cross-pollination, is larger and heavier than that of the parent strain. In a recent experiment a different result has been obtained, and the causes of this contradiction have been investigated.

Two lines of tomato (105 and 107) were crossed in both directions and also *artificially* self-pollinated. Fruits were killed and fixed at different times after pollination and the seeds and embryos measured. If the development of the hybrid embryo is compared with that of the selfed maternal parent, it is found that in each case the hybrid embryo is significantly larger in the earlier stages of development, but that this initial advantage is not maintained. In the ripe fruit the hybrid embryo is the same size as the embryo of the selfed maternal parent. This is illustrated in the accompanying graph. The final size of the reciprocal hybrid embryos, which are of identical genetic constitution, is significantly different, and is evidently determined by the maternal parent. The final size of a hybrid embryo is thus no criterion of the degree of heterosis. The results for the size of the whole seed were exactly similar, and this agrees with the fact that, in the tomato, seed size and embryo size are highly correlated.

The relation of the embryo to the fruit is a double one. Development of fruit and size attained depend on the presence of growing embryos: but the size of seeds is also determined or limited by the nutritive supplies from the fruit. In this investigation of the tomato it was found that 'fruit weight' was highly correlated with 'seed number' ($0{\cdot}735 \pm 0{\cdot}041$) and this confirms the first relation. Also 'mean seed weight' was directly correlated with 'fruit weight/seed number', that is, 'fruit weight per seed' ($0{\cdot}560 \pm 0{\cdot}061$). This illustrates the second. It may be said, therefore, that the 'mean seed weight' is determined primarily by the number of seeds which chance to develop in a fruit.



MATERNAL INFLUENCE ON EMBRYO DEVELOPMENT.
A. 107 and (107 × 105). B. 105 and (105 × 107).
○ Parent embryos; ■ hybrid embryos.

In a further experiment with the tomato, the seeds of hybrids were compared with those of the selfed parent, the more usual technique of allowing self-pollination to take place *naturally* being employed. In the hybrids (*artificially* pollinated) the seed number was lower and the value of fruit weight/seed number much higher. The mean seed weight of the hybrid was greater than that of the selfed parent. Data are given in the following table.

	Parent 107 Natural pollination	Hybrid 107 × 105 Artificial pollination	Ratio hybrid / parent
Mean seed No.	207	143	
Mean fruit wt. per seed	0·554	0·702	1·27
Mean seed wt. (mgm.)	3·055	3·866	1·27

This is the result obtained by Ashby and Luckwill. It is clear, however, that the greater seed size is not due to heterosis, but to the fact that fewer seeds developed in the hybrid than in the naturally selfed—and therefore more efficiently pollinated—parent. In the embryo development experiment first quoted, where all the progeny were the result of artificial—less efficient—pollination, there is no difference between the seed size of the hybrid and that of the maternal parent.

EDWIN S. J. HATCHER.

Department of Botany,
The University,
Bristol, 8. Feb. 8.

[1] Ashby, *Ann. Bot.*, n.s., **1** (1937).
[2] Luckwill, *Ann. Bot.*, n.s., **1** (1937).

A Gold Sol Test for Bovine Mastitis

ERADICATION of bovine mastitis is one of the major problems confronting dairy research, and the solution of the problem depends to a large extent on trustworthy methods for detecting udder infections, particularly of the sub-clinical type. Many tests have been proposed, but none appears to compare in reliability with the method of isolating the causative micro-organisms by plating on selected media.

A promising chemical test was recently put forward by Rowland[1] in which the characteristic changes in the percentage distribution of the milk proteins are utilized. Rowland showed that even in sub-clinical mastitis the percentage of casein-nitrogen falls below the normal level. This loss in casein is primarily outbalanced by a rise in globulin, and this suggested the possibilities of working out a method similar to Lange's gold test for cerebrospinal fluid, a test which is largely bound up with pathological changes in the globulin content of this body liquid. Owing to the predominance of casein, no characteristic results could be obtained with whole milk, but a sensitive test was procured with casein-free milk serum prepared in the manner described by Rowland and titrated back with sodium hydroxide, using methyl red as indicator, to a *p*H in the region of 6·0–6·5. When 5 ml. of a red gold sol prepared in accordance with Lange's directions are mixed with 1 ml. of this serum, the colour of the gold sol remains unaffected by sera from milk of healthy individual cows or quarters, but turns instantaneously to violet or blue in the case of even slight infection of the udder.

The results so far of this simple and rapid test seem to correlate particularly closely with the bacteriological findings regarding the presence or absence of mastitis-producing organisms in the milk. Experiments with dilution series suggest that the correlation between globulin content or globulin/albumin ratio and the intensity of the colour changes is not of a simple nature, and preliminary investigations indicate that the proteose-peptone fraction of nitrogenous compounds of the milk also participates in the reaction.

A detailed study of all the factors involved is now in progress.

R. ASCHAFFENBURG.
National Institute for Research in Dairying, University of Reading.
Feb. 28.

[1] *J. Dairy Res.*, **9**, 47, 174 (1938).

Points from Foregoing Letters

BY isolation of the natural *K* X-radiation, and also by chemical tests, it has been shown by N. Feather and E. Bretscher that an isotope of iodine is one of the active products formed by the action of neutrons on uranium, and previously regarded as belonging to a series of transuranic elements.

The formation of radioactive noble gases during the irradiation of uranium with slow neutrons has been studied by F. A. Heyn, A. H. W. Aten jun,, and C. J. Bakker. It is shown that the nucleus can be split in different ways, giving rise to either krypton or xenon. Several decay products of these gases are observed. Bombarded with fast neutrons, thorium also is found to form noble gases too.

L. J. le Roux, C. S. Lu and S. Sugden record experiments in which two further reactions (the condensation of alkyl bromides with aniline and the hydrolysis of *n*-butyl bromide) have been used to separate the isomeric ^{80}Br nuclei. These results confirm the discovery of Segrè, Halford and Seaborg and of DeVault and Libby that the ^{80}Br nucleus of period 4·5 hour decays by a γ-ray change to give the isomeric ^{80}Br nucleus of period 18 minutes.

On the basis of X-ray experiments on iron-nickel alloys, A. J. Bradley offers a new explanation of the structure of some meteorites. These bodies may consist of a mixture of large α- and γ-crystals, corresponding to a state of equilibrium at some temperature between 350° and 580° C. It is suggested that they have gradually assumed this state while in the neighbourhood of the sun, which they encircle in a cometary orbit.

N. Gralén and The Svedberg state that sedimentation and diffusion experiments show that the hypothesis proposed by Talmud for 'intraglobular' reactions based upon Wrinch's theory of protein structure cannot explain the formation of a complex between egg albumin and glycine ethyl ester. It is suggested that the complex can be considered as a chemical compound, and with the glycine residues bound on the outside of the protein molecule.

P. Stamberger finds that the coagulation of rubber latex from *Hevea brasiliensis* takes place 6–11 hours after collection, before decomposition processes have set in. No change in electrical conductivity could be observed during that period. The coagulation is apparently due to the action of enzymes on the protecting proteins.

W. J. Hickinbottom reports that a study of the isomerization of benzyl phenyl ether in quinoline solution has yielded results which demonstrate that the isomerization is preceded by an initial fission of the ether into free radicals.

X-ray investigation of the fluoride-containing mineral ralstonite shows, according to A. Pabst, that it has a structure similar to that found in the pyrochlore group.

Œstradiol produces in immature rats changes in the water content of most organs and tissues, according to experiments by S. Zuckerman, A. Palmer and G. Bourne. The skin, uterus and vagina show an increase in the water content in the first six hours, then a fall until the 24th hour, and then again an increase until the 66th hour. The water content of the striated muscle, heart, pancreas, brain and gut, on the other hand, changes mainly in the opposite way from that described above.

The fungal disorganization of plant residues in dung and composts has been studied by F. Baker by direct microscopical observation in polarized light. Characteristic disintegration patterns are illustrated. Fungal attack originates in the lumen of fibres, fine hyphæ penetrating the tertiary and proliferating in the secondary layer of the wall. The primary layer remains immune from attack.

Some experiments described by E. S. J. Hatcher show that the large hybrid seeds and embryos obtained by crossing two inbred strains of tomato are not the direct expression of hybrid vigour. They are the effect of reduced competition between fewer seeds which are produced by artificial and therefore less efficient pollination.

A new test for bovine mastitis based on a reaction between casein-free milk serum and solutions of colloidal gold is outlined by R. Aschaffenburg.

Research Items

Sarcee Indians of Alberta

As little has been published about the Sarcee Indians, the National Museum of Canada sent Diamond Jenness to a reserve near Calgary to study their old customs and beliefs. The material gathered has now been embodied in a report of the Canadian Department of Mines and Resources (*Bull.*, No. 90, Anthropol. Ser. 23, 1938). Though frequently mentioned by European explorers of the eighteenth century, the Sarcee did not become regular visitors to any trading post until the last decade of that century. In the inter-tribal warfare of the earlier nineteenth century, the Sarcee, being one of the weaker tribes, joined themselves to the Blackfoot Confederacy. Throughout the nineteenth century, they suffered much from the effects both of warfare and epidemics, so that by 1924 the number on the reserve had been reduced to 160 individuals only. In physique, mentality and customs they seem scarcely distinguishable from Blackfoot Indians; but they have retained an Athapascan tongue. They were a democratic people, who did not countenance hereditary distinctions of caste or rank. They were divided into bands containing a number of closely related families, that usually hunted together and always camped as a unit when the tribe was united. Girls belonged to their mother's bands; boys above the age of nine or ten years to that of the father, though still retaining close contact with their mother's band. The bands seem to have been very fluid, constant neither in number nor composition. Each band had its leader, who was not elected, but was recognized by common consent because of his prestige. Although he possessed no formal authority, his advice and instructions were rarely disobeyed. Separate from the bands and cutting across them were five societies or clubs, to one or more of which every male Sarcee belonged at some time or other. Each society held an annual four days' dance, being dormant for the rest of the year.

Androgens and the Ovary

M. Mazer and C. Mazer (*Endocrinology*, **24**, 175; 1939) have found that, in the immature rat, prolonged administration of the androgen testosterone propionate caused a decrease in the weight of the pituitary, adrenals, ovaries and uterine horns and inhibition of œstrus with mucification of the vaginal epithelium. The degree of uterine atrophy was not in proportion to the ovarian atrophy, probably because the suppression of œstrogen production was partly counterbalanced by the direct stimulative effect of testosterone on the uterus. The adult rat reacted similarly except that the pituitary gland showed no significant decrease in weight. The deleterious effect of prolonged testosterone treatment on the ovaries was temporary. Restitution of structure and function occurred within 29 days. The literature and the authors' experiments showed that the duration of treatment was the determining factor in the effect of testosterone on the ovaries; short treatment produced stimulation and prolonged treatment depression. The ovarian atrophy, in the authors' opinion, was secondary to pituitary inhibition.

Glucose Excretion in Diabetic Dogs

P. Govaerts and P. Muller (*J. Clin. Invest.*, **18**, 25; 1939) have investigated the excretion of glucose and creatinine in dogs made diabetic by pancreatectomy. The creatinine clearance being considered as a measure of the glomerular filtration and the glucose concentration of the arterial plasma as equal to the concentration of this substance in the glomerular filtrate, the quantity of glucose which the tubular cells reabsorbed from 1 c.c. of glomerular filtrate could be calculated. This figure was called the 'threshold'. When the blood-sugar concentration increased moderately, this threshold increased, and with further elevation soon reached a maximal value which remained constant for any higher level of glycæmia. In the diabetic dog at high levels of hyperglycæmia, a constant part of the filtered glucose saturated the reabsorptive power of the tubular cells, and the remainder was completely excreted as in a phlorizinized dog. These characteristics of the renal function did not change appreciably in the diabetic dogs during a period of observation lasting several months.

A Fossil Whale from Australia

In the older Tertiary rocks at Torquay, Victoria, B. G. Pritchard and his assistants discovered and collected from a cliff face the greater part of the skull of a zeuglodon whale, described as belonging to a new genus *Mammalodon* (*Victorian Nat.*, **55**, 151; Jan. 1939). Various discoveries of fossil whale remains, consisting mostly of teeth, have been made in the Tertiary deposits of Australia since McCoy's first record of *Squalodon* or *Phocodon* from the Miocene of Cape Otway in 1864. But the present find differs from them in the small size and delicate build of the skull and of the teeth and their cusps. Dr. Pritchard considers it to be a very early type of Tertiary whale, "showing the closest approach to descent from a mammalian type of ancestor". The age of the rocks from which it was recovered is a matter of controversy, for they have been attributed to various periods ranging from Miocene to Eocene, but the author favours their Eocene origin.

Reproductive Organs of the Silk Worm Moth

Seinosuke Ômura has recently issued a notable paper on this subject (*J. Fac. Agric. Hokkaido Imp. Univ.*, **40**, Pt. 3; 1938). In so far as the female organs are concerned, the work is directed to tracing the whole history of the spermatozoa from when they are discharged into the bursa copulatrix. It appears that the spermatophore, ejected by a male, occupies the greater part of the cavity of the bursa. Several hours after ejaculation, the spermatozoa fill the receptaculum seminis. They enter the ductus seminalis by their own motility, while their passage along this duct is aided by means of peristaltic movement of its muscular walls. About thirty minutes after mating, spermatozoa were appearing in the receptaculum seminis. The author claims that the sperms enter the receptaculum by its duct, the so-called ductus tortuosus. On the other hand, when they leave the receptaculum, to fertilize the eggs, he states that

they pass down the hitherto unrecognized canaliculus fecundans. Each egg, in its passage to the exterior, passes in such a manner that its micropyle is opposite the opening of the caniculus into the vestibulum, and in this way becomes fertilized. The average time for laying each egg is only 6·7 sec. As regards the male organs, Ômura points out that the ductus ejaculatorius of most authors is divided into three parts, namely, glandula spermatophora, glandula alba and glandula prostatica. The histology of the different parts of the male reproductive system is described and figured while the functions are discussed in some detail. The mechanism of ejaculation, and of spermatophore formation in the bursa of the female moth, is also described. The author claims that the secretion of the glandula prostatica is necessary for the proper functional activity of the sperms. The translocation of the spermatozoa from the testis into the post-testicular parts takes place, it appears, some four days before the moth emerges from the pupa.

Genetics in the U.S.S.R.

IN February 1938, a conference on interspecific and intergeneric hybridization, arranged by the Institute of Genetics, was held at the U.S.S.R. Academy of Sciences at Moscow. A hundred and fifty scientific men took part, and more than forty papers were read. Profs. Vavilov, Kostoff and Luss gave critical surveys of the present-day knowledge of distant hybridization and its importance in the improvement of plants and animals and to a better understanding of evolution. Reports were also made of work on hybridization in cereals, tobacco, fruits, forage crops and potatoes. Work on the crossing of various species of *Agropyron* with wheat, on the artificial induction of amphidiploidy (that is, of chromosome doubling in hybrids) and the genetics of animals was also considered. The proceedings of the conference have recently been published (*Bull. Acad. Sci. U.R.S.S.*, Ser. Biol., Nos. 3 and 4. Summaries in English).

Organic Compounds Toxic to Fruit Pests

Two types of winter wash are necessary for fruit trees. Tar distillates are toxic to the eggs of aphides and apple sucker, but have little effect on those of capsid or red spider. Petroleum oils, on the other hand, are toxic to eggs of red spider and capsids, but not to those of aphides and apple sucker. H. Shaw and W. Steer (*J. Pom. and Hort. Sci.*, **16**, 364; 1939), in attempting to find a single substance toxic to both these groups, have investigated the ovicidal properties of 44 organic compounds consisting of di-nitrophenols, thiocyanates, naphthalene derivatives and organic bases. As a result of field and laboratory tests on eggs of the vapourer moth (*Orgyia antiqua*), the green apple aphis (*Aphis pomi*), the winter moth (*Operophtera brumata*), red spider (*Oligonychus ulmi*) and apple sucker (*Psyllia mali*), a large proportion of the materials tested was eliminated as showing little promise as winter ovicides. These included all but two of the thiocyanates, the naphthalene derivatives, and the bases other than nicotine and some of the quinoline and iso-quinoline compounds. The materials regarded as worthy of extended trial were 3 : 5 dinitro-cresol, *n*-dodecyl-thiocyanate (lauryl rhodanate), β-butoxy-β′thiocyano-diethyl ether and nicotine. All these are suitable for use as supplements for winter petroleum washes. The authors discuss the mechanism of the toxicity of nicotine in some detail, and favour the view that it penetrates the egg shell and interferes with the development of the embryo.

Soil Decomposition of a Plant Pathogen

SEVERAL fungi which attack plants from the soil disappear when the host is not grown for a certain period. S. D. Garrett, of Rothamsted Experimental Station, has made a study of this action with *Ophiobolus graminis*, the fungus causing 'take-all' disease of wheat (*Ann. App. Biol.*, **25**, No. 4, 742; 1938). The fungus apparently disappears as a result of natural decomposition by other micro-organisms of the soil. It will remain alive indefinitely in air-dry soil, at low temperatures of 2–3° C., and under sterile conditions. Decay of *Ophiobolus* mycelium is quickest when conditions are such that the normal micro-flora of the soil is greatest. Addition to the soil of energy materials lacking nitrogen, such as glucose or starch, hastens the destruction of mycelium, whilst dried blood, with readily available nitrogen, has the opposite effect. Soil conditions which are least favourable for the parasitism of *O. graminis* may, in fact, best preserve the organism during the non-pathogenic phase.

Proteins and Viruses

PROTEINS which possess the active principle of plant viruses have been isolated by W. M. Stanley and by F. C. Bawden and N. W. Pirie from diseased hosts. Hideo Moriyama and Shunkichi Ôhashi have studied the properties of certain proteins precipitated from healthy plants, and compared them with virus proteins (*J. Shanghai Sci. Inst.* (Sect. 4), **4**, 17; 1938). Normal proteins which form minute masses visible under the microscope or ultra-microscope, were obtained without exception from healthy leaves of cucumber, kidney-bean, tomato, poplar, spindle-tree, dandelion, lettuce and egg-plant, and also from petals of bindweed flowers. They were precipitated with acetic acid at a certain hydrogen ion concentration, a method which Moriyama has also used for the isolation of vaccinia virus protein and phage protein. Some of the protein precipitates exhibited double refraction and all had a low content of nitrogen; they are lipo-proteins. It is suggested, from the general similarity of these preparations with virus proteins, that virus attack disintegrates the protein of the host, appropriates some of the decomposition products for its own formation, and leaves an unbalanced physiology which induces the observed pathological conditions.

Mechanical Properties of *Pinus radiata*

ONE of the exotics which has been most extensively planted in Australia and New Zealand is *Pinus radiata*. It grows comparatively fast and it is therefore not surprising that doubts should have been expressed as to the quality of timber that will result. In a previous pamphlet (No. 81), general information on the timber of the species was given. In the present pamphlet, No. 87 (Melbourne, 1938) "The Mechanical Properties of South Australian Plantation-grown *Pinus radiata*", by Ian Langlands, published by the Council for Scientific and Industrial Research, Australia, the results of the mechanical tests to which the timber has been subjected are given. This little brochure is divided into two parts. The first gives in non-technical language the chief results of

the tests; in the second the detailed results and the methods of analysis are given. The tests show that *Pinus radiata* ranks fairly high among other conifers in so far as its mechanical properties are concerned. A considerable variation in properties according to the position in the tree was found, the sapwood near the butt usually being the strongest portion. The direction of loading relative to the rings did not affect the static strength properties, with the exception of cleavage strength. The impact strength, however, was higher when the load was applied to the tangential surface. Statistical analysis showed that, although there is a correlation between mechanical properties and density, it is not sufficiently high to enable the properties of any particular piece to be estimated from its density. The pamphlet contains a discussion on the influence of rate of growth on the properties of the timber, and also gives a table of permissible working stresses.

The Illinois Basin Earthquake of November 17, 1937

THE Illinois Basin is now considered a seismic district, especially for small shocks. Earthquakes occurred there on January 30, 1907, April 30 and May 1, 1920, March 8, 1923, and November 17, 1937, and this latter has been studied by Ross R. Heinrich and Albert Frank (*Earthq. Notes*, Eastern Sec. Seis., Soc. Amer., **10**, No. 3, Dec. 1938). Questionnaire cards were sent out, and, 160 being returned, much macroseismic evidence was available in order to draw a map showing the isoseists on the Wood-Neumann scale. In the centre shocks of intensity V are experienced, rolls of linoleum in the stores being toppled over and canned goods shaken off the shelves. The area covered was approximately 8,000 square miles. This macroseismic data agreed very well with the results obtained by reading the seismograms recorded at various towns. This latter evidence, using Joliat's tables for near earthquakes, gave T_0 11h. 4m. 47·7s. C.S.T. and epicentre lat. 38° 34′ N., long. 89° 5′ W., about midway between Centralia and Odin. The epicentre was thus on the north-west limb of the Illinois Basin syncline and on the eastern flank of the Junction City dome. Faults exist near, but not at, the epicentre.

Copper Sulphate Pentadeuterate

A SHORT announcement by F. Schacherl and O. Běhounek appeared a few years ago in NATURE (138, 406; 1936) describing the preliminary results of their investigation of copper sulphate crystals containing heavy water. These authors have now extended their observations (*Coll. Czechoslovak Chem. Commun.*, **11**, 57; 1939). The pentadeuterate is greenish in contrast with the blue pentahydrate, and its dissociation, according to the equation

$$CuSO_4\ 5D_2O \rightleftarrows CuSO_4\ 3D_2O + 2D_2O$$

has been studied over the range 20° C. to 60° C. The dissociation pressures of the two deuterates, measured tensimetrically, satisfy the equations

$$\log_{10} p = 11{,}176 - \frac{3086 \cdot 98}{T} \quad \text{and}$$

$$\log_{10} p = 10{,}625 - \frac{2956 \cdot 88}{T}.$$

The heat of 'hydration' of the pentadeuterate at 25° C. is 6·96 kcal.; that for the pentahydrate is 5·32 kcal., which suggests that D_2O is more firmly bound to the anhydrous salt than water is.

The Ionosphere

IN the issue of the *Journal of Research* of the U.S. Bureau of Standards of December 1938, N. Smith, T. R. Gilliland and S. S. Kirby give a summary of the results deduced from their observations of the heights of the various layers of the ionosphere and the critical frequencies at which reflection from them ceases, during the years 1933–38, in which sunspot frequency has increased. The daily and seasonal changes were regular over this period. The *E* layer had a minimum height of 110–120 kilometres, and its critical frequency varied as the fourth root of the zenith distance of the sun and as the intensity of solar radiation. At night the *F* layer had a minimum height of 300 kilometres; in the daytime it descended to 225 kilometres and in the summer had a second member at 350–400 kilometres. The critical frequencies for these layers were much higher than for the *E* layer and less regular. The long-period variations of critical frequencies for all the layers followed closely the variations of sunspot numbers. While the latter increased from 5 to 120, the critical frequencies increased for *E* by 25 per cent and for *F* by about 100 per cent, corresponding to increases of ionization of 55 per cent and 300 per cent respectively.

Total Solar Eclipse of June 8, 1937

C. B. MICHIE has recently published a report of the New Zealand Total Solar Eclipse Expedition to Canton Island on June 8, 1937 (*Mon. Not. Roy. Astro. Soc.*, **99**, 2; 1938), in which he gives a brief description of some of the results obtained, more especially with the 19-ft. coronagraph and the 78-in. camera. It is interesting to notice that the two instruments gave very different results. The coronagraph showed a wonderful wealth of detail throughout the inner corona, and, in addition, the prominences were well defined. Nevertheless a 45-seconds exposure failed to reveal the corona beyond 1·5 diameters from the limb of the sun. By using the 78-in. camera it was possible in some cases to follow the streamers to distances of 3·5 or more diameters. The camera was provided with a rotating sector to enable photographs to be taken with the object of studying detail over a wide range of light intensity. The photographs obtained in this way and also the short exposure plates taken with the coronagraph showed several dark regions in the corona extending inwards to the rim of the eclipsed sun. From these and other details there is the suggestion of electromagnetic fields in action.

Radiants of the Orionid Meteor Shower

J. P. M. PRENTICE, director of the Meteor Section of the British Astronomical Association, has recently issued a paper with the above title (*J. Brit. Astro. Assoc.*, **49**, 4; 1939) in which he gives an account of his work on the Orionids in 1936 and 1938. In previous papers he suggested that there is a 'radiant pattern' for this stream, and that the various centres of radiation are not stationary, as Denning believed. There was the further suggestion that each stream, as it moved eastward, came to a maximum on the same meridian of right ascension at about $\alpha = 96°$. The paper gives very full details of the work which was carried out to investigate the last result, and Prentice is convinced that the Orionid streams have a standard meridian of maximum at $\alpha = 96°$. This result is very interesting, but there seems to be no physical explanation for it.

The Indian Science Congress Association

Lahore Meeting

THE twenty-sixth meeting of the Indian Science Congress Association was held in Lahore in January, this being the third occasion upon which the Congress has met in the capital of the Punjab.

The president of the Association, Prof. J. C. Ghosh, professor of chemistry in the University of Dacca, devoted the first part of his address to a survey of the development in India of chemical research during the last decade. He showed that the appeal made by Prof. J. L. Simonsen in 1928 for a more intensive study of India's rich natural resources has met with a gratifying response, and, whilst deploring the lack of interest in inorganic chemistry, he was able to point to the valuable contributions made to physical chemistry. He directed particular attention to Prof. Bhatnagar's outstanding work in magneto-chemistry, to Prof. J. N. Mukherjee's elaborate investigations on the colloid chemical behaviour of soil constituents, and to the work of his own laboratory on the interplay of matter and radiation.

The second part of his address was an appeal for the formation in India of an All India Council of Scientific and Industrial Research. Research in agriculture has received generous support from public funds, but little or no attempt has been made to implement the recommendations of the Holland Industrial Commission. He suggested that there is little prospect of the schemes for industrial development, advocated at a recent conference of the Provincial Directors of Industry, meeting with success unless this development is supported by well-equipped and adequately staffed research organizations.

THE EARTH'S MAGNETISM AND THE UPPER ATMOSPHERE

The presidential address given by Dr. K. R. Ramanathan to the Section of Mathematics and Physics was devoted to geomagnetism; it was an extremely interesting, well-balanced and up-to-date survey of this subject, which after many decades of relative neglect has again begun to attract the attention of physicists. Apart from the standing challenge to theoretical physicists which is offered by the problem of the existence of the main magnetic field of the earth (and also of its secular variation), the subject has come into new prominence through its bearing on radio physics (the properties of the ionosphere) and on the entry of cosmic rays into the earth's atmosphere. Solar physicists are also concerned with the subject, because the time-pattern of geomagnetic disturbance, undoubtedly due to the sun, differs materially from that of the main changes hitherto observed on the sun's surface, and indicates that solar changes of much terrestrial significance are not yet properly distinguished by solar observers.

Dr. Ramanathan's address was mainly devoted to the transient changes of the earth's field, which are associated with the sun and the ionosphere, but he also dealt briefly, at the outset, with the main field, in connexion with which he made some interesting quotations from the great memoir by Gauss on the spherical harmonic analysis of this field. In his survey of the transient variations, Dr. Ramanathan described the solar and lunar daily magnetic variations, magnetic storms, and—what is the most recently established type—the brief disturbances affecting only the day hemisphere, associated with radio fade-outs and solar eruptions. He rightly directed attention to the important contributions to geomagnetic science that have come from India, namely, the important work of Broun on the lunar daily magnetic variation, based on the data obtained at the Trivandrum magnetic observatory maintained for many years by the Maharajah of Travancore, and the truly monumental discussion of the Bombay magnetic data, by Moos. In recent years new Indian contributions to ionospheric studies have come from Profs. M. N. Saha and S. K. Mitra and their students.

In his survey of geomagnetic problems, Dr. Ramanathan provided an admirable brief outline of the present state of knowledge in this field, which should be of value to physicists everywhere who desire an introduction to the subject.

ANALOGY AMONG CHEMICAL ELEMENTS AND RADICALS

The first part of the presidential address to the Section of Chemistry, by Prof. P. B. Sarkar, included an account of the volumes and magnetic properties of ions and the relation between these properties and colour with the electronic structures of the rare earth ions. The effect of deformability was considered in its relation to isomorphism, where the influence of ionic radii was fully explained.

In this part of the address special emphasis was laid on the modern explanation of cases of isomorphism which cannot easily be understood or explained on the older views. As an example, it is stated that the ionic radii of S^{6+} and Be^{2+} are both 0·34 A. The only difference between the two ions is in their polarizing power. A series of isomorphous simple and double sulphates and corresponding fluoberyllates have been prepared by Rây, and in almost all cases the fluoberyllates resemble the corresponding sulphates in both physical and chemical properties. The X-ray spectrum of barium fluoberyllate is practically indistinguishable from that of barium sulphate.

Although pure alkali aluminium fluoberyllates corresponding with alums have not been prepared, mixed crystals of alums containing both sulphates and fluoberyllates have been obtained. Prof. Sarkar directed attention to the analogy between the monofluophosphate ion PO_3F'' and the sulphate ion SO''. Several simple and double monofluophosphates as well as compounds of the alum type isomorphous with the corresponding sulphates have been prepared in his laboratory. Another case of isomorphism supported by mixed crystal formation is afforded by the formates and nitrites studied by Rây.

Prof. Sarkar concludes that three essential factors determining chemical similarity are (i) equality of ionic charge or valency, (ii) similarity of structure, and (iii) approximate equality of ionic radii. Of

these the first is the most important and demands complete equality, whereas the other two permit of slight deviation within a narrow range.

Conservation of India's Mineral Wealth

Dr. S. K. Roy, in his presidential address to the Section of Geology, chose as his theme the conservation of India's mineral wealth. Considering the vast size of the country, mineral occurrences are few and far between, and for this reason alone they should be stringently conserved to meet the growing demands of industry and national defence. India possesses deposits of both coal and petroleum, and attention should be directed towards their conservation.

Owing to the number of serious accidents which have occurred during recent years, researches on safety in mines have taken precedence over fuel research. Hydraulic packing, known as sand-stowing, has been found by the Coal Mining Committee to be an efficient method of preventing practically all major disasters, and there is no reason, therefore, why this should not be put into practice by law and the energies of experts now turned towards fuel research. There is ample scope for this, particularly in the Jharia coalfield, where about 30 million gallons of tar are wasted annually in production of soft coke. Of the 300 million gallons of petroleum consumed annually, only 76 millions are produced in India, and yet little is done to conserve the limited supply available.

Apart from coal and oil, there are a great many minerals which should be conserved. India is by far the largest producer of mica and could well command the world market were the industry efficiently organized. As things are, the mica deposits are for the most part exploited by unscrupulous small capitalists anxious only to fill their own pockets. Once they have recovered such mica as is easily available at the surface, they abandon the deposits. Thus in course of time valuable underground resources become overgrown and no one is aware of their existence. Another source of loss to the mineral wealth of India is the exceedingly low price at which minerals such as kyanite, magnesite, manganese, beryl, etc., are exported, simply because there is little demand for them within the country itself.

The history of India shows that years ago metals such as gold, silver and copper were available in large quantities. Diamonds also occur at three different geological horizons, and until the middle of the last century India supplied 98 per cent of the world's output. At the present time, however, diamond mining is extinct.

India cannot afford to ignore this wealth, which with the help of properly trained geologists, mining engineers and chemists, backed by local government departments, could be exploited to the advantage of the nation as a whole.

The Geographical Personality of India

The presidential address by Mr. N. Subrahmanyam to the Section of Geography and Geodesy covered widely, if superficially, almost every aspect of the life of India in an attempt to assess the present characteristics and the direction of change of Indian civilization to-day.

A review of physical factors, including climate and its effect on production, was comprised under the heading of static geography. Then followed under the heading of dynamic geography an account of the more modern influences that are permeating India and an estimate of their effect. India has long been awakening into modernity through impact with Europe, and particularly through British permeation. Her isolation has gone: new forces permeate cities and towns and through the motor-car and radio are reaching the villages, where eighty per cent of the inhabitants dwell. Self-sufficiency is rudely shaken: even caste is adapting itself to new conditions. The old conditions and obstacles to progress such as pressure on the land, recurrent famines and appalling poverty are no longer accepted; their courses are recognized to be removable.

In short, man in India has fallen behind, but now he is catching up and bids fair to take full advantage of his opportunities. A new composite civilization should emerge as a synthesis of Eastern and Western cultures. From the medieval India there is emerging, though naturally not without discord in places, a modern India.

Indian Forest Mycology

Dr. K. D. Bagchee's presidential address to the Section of Botany dealt with Indian forest mycology with special reference to forest pathology. It was in the early years of this century that Dr. E. J. Butler, at the time mycologist to the Agricultural Research Institute at Pusa inaugurated by Lord Curzon when Viceroy of India, wrote a paper or two on Indian forest fungi published in the *Indian Forester*. The subject, then almost a sealed book, has remained so until within the last few years. Dr. Bagchee's address shows that considerable progress is being made in a fascinating branch of forest studies, and one which will become of increasing importance in the years to come.

Dr. Bagchee stated that most of the forest diseases of India, including heart-rots, are indigenous. They seldom become epidemic, the organisms causing them being more or less in a biological balance with their hosts. When this balance is disturbed by unusual weather conditions or other factors, an indigenous disease temporarily becomes epidemic; when the disturbance ends, the disease resumes its former status, effecting cumulative damage through slow and constant action. But parasites coming into a new region often find some species particularly susceptible to their attack, because of the lack of any established balance between the parasite and the host, and thus an epidemic breaks out.

It may be pointed out that the balance mentioned above under which the primeval forest has maintained itself through the ages may be, and often is, interfered with by good forest management, the sylviculturist endeavouring to eliminate Nature's exuberant abundance in the production of material of little economic use and to increase the volume of the crop per unit of area whilst keeping it clear of dead and dying material. Whilst on one hand this should reduce the danger from insect or fungus pests, in epidemics the reverse may be the case. In plantations of one species, especially exotics, the forester has already realized the position.

Dr. Bagchee divided his subject into six main heads: (1) Coniferous rusts affecting conifers in the mountains; (2) root-and-stem-rotting fungi killing conifers in the mountains and hardwoods in the plains; (3) canker pathogens infesting native and

some introduced hardwood species; (4) nursery diseases; (5) timber diseases—timber-rotting fungi; (6) ecology and habits of the forest fungi of the forest floor or on the woody undergrowth or sub-aerial parts of the trees.

Dr. Bagchee discussed in some detail the diseases which he has studied, and dealt with certain possibilities of control measures. The address is a valuable contribution to the available knowledge on this subject.

Batrachians and Their Environment

The president of the Section of Zoology, Prof. C. R. Narayan Rao, directed attention in his address to changes induced in closely related frogs and toads by different influences of environment. The observations are of special interest because they are due to the author's own studies in an area of highly diverse physiographical conditions, and because they illustrate the possibilities that lie in ecological work of this kind. To select one or two of his points. We are accustomed to think of batrachians as limited to regions of great humidity, but some live continuously in "conditions of extreme dryness". These show distinctive adaptations: some inhabit deep burrows except during a short humid period; in *Uperodon* the skin is developed to absorb and retain water, which may thus be available during drought. Aquatic batrachians have large kidneys; those attuned to dry conditions possess relatively small kidneys, a correspondingly large bladder and a surprisingly small amount of excretory products in the urine. Lastly, the aquatic forms reduce the exposed area of moist skin by resting flat upon the ground, whereas the others sit with a half-perpendicular pose.

Another striking correlation, suggested tentatively by Prof. Narayan Rao, is that between the presence or absence of the tympanum and the temperature of the air or water in which the batrachians live, for he finds that higher temperature leads to conspicuous development of the tympanum, lower temperature to its reduction or absence. Temperature seems also to rule the shape of the body, cold temperatures inducing rather globular forms with reduction of surface area; whereas high temperatures are associated with extensive surfaces, and with the habit of æstivation, which sets in at 105° F.

Frogs typical of dense areas of jungle have elongated bodies and shortened hind limbs. Species represented both in forest and on high ground lay fewer eggs in hill streams and pools and, correlated with the smaller ovary, the fat-body also undergoes reduction. The studies made by Prof. Narayan Rao in South India offer many suggestions which workers in other parts of the world will be anxious to test upon their own amphibian population.

Tribal Culture Contacts and Acculturation

In India there are nearly thirty million primitive peoples, among whom tribal society in many areas is experiencing depopulation through changes in economic and social life. In certain groups, however, which have not lost their vitality and interest in life, cultural contacts bring about the selective adoption of alien traits, a cultural symbiosis or acculturation. This topic formed the subject of Dr. D. N. Majumdar's presidential address to the Section of Anthropology.

Nowhere in India is this cultural symbiosis or acculturation more patent than in Bastar, an important feudatory State of the Central Provinces. Here the native population is Gond. Foreigners and immigrants, claiming Kshatriya origin, are believed to have mixed freely with the native population. Two groups, having social precedence, claim Kshatriya origin; the remaining groups are regarded as of indigenous origin, probably with good reason. The linguistic and ethnic frontiers in Bastar are very uncertain; and it has for long been a melting-pot of races and groups. The infiltration into an aboriginal area of caste peoples, who dominate the native population, has resulted in an interdependence of the two groups. The *Kabadi* custom is an example of this interdependence and co-operation. According to this custom, when a member of one of the inferior groups is in urgent need of money, for example, for the payment of a fine, or to meet the expense of a ceremonial wedding, he will borrow from the master for whom he works, repaying by agricultural service. Formerly, when tribal organization was strong, if such a sum of money was required, it was raised by group effort. Now that tribal and group solidarity is dissipated, the economic helplessness of the inferior groups is exploited by the caste people, the loans often entailing lifelong servitude, which may pass to his heir, if a man dies while still in debt.

Nevertheless, in some areas economic interdependence has led to a healthy reciprocity in cultural life, as, for example, in the Dusserah religious festival, which has brought together the various cultural groups of Bastar as participants in a great cultural heritage. Further, many indigenous institutions survive to serve a useful purpose. Such, for example, is the dormitory institution, where unmarried youths and girls collect to dance and sing together at night. Originally, under tribal organization, this institution was intended to enable the warriors to lie in readiness to protect the women and property of the group from raids. It now serves as an educational institution, in which the young people learn the group standard of social life, discipline, the economic pursuits characteristic of the group, social and ceremonial duties relating to sex and associated matters. Thus the dormitory now fulfils an important role in the tribal life of the community.

Insects and Their Role in Indian Agriculture

Under this title Dr. T. V. Ramakrishna Ayyar contributed an interesting presidential address to the Section of Agriculture. The substance of his discourse was a general survey of insects in relation to man and, in particular, in connexion with problems of Indian agriculture.

After discussing estimates of losses due to insect depredations in the United States, Dr. Ayyar compare similar losses in India. In so far as rice, wheat, cotton, sugarcane and oil-seed are concerned, he computes the annual losses of these crops, alone, at more than 200 million rupees. While the insect pest problems of the different areas of India differ considerably in geographical, climatic and other conditions, and according to the crops grown in each region, there are a few species of so wide a range as to affect India as a whole. Of these latter, locusts are of primary importance, and especially noteworthy was the large-scale infestation of the desert locust (*Schistocerca gregaria*) during 1926–31.

After reviewing various artificial methods of insect

control, the subject of natural or biological control was then considered. In South India, biological control has so far been tried on an organized scale against two species of insect pests. One, the fluted scale (*Icerya*), which was introduced into the Nilgiris about 1927–28, has been considerably checked but not completely exterminated by the beetle *Novius cardinalis*. The other pest, the coco-nut caterpillar (*Nephantis serinopa*), is indigenous and has a complex association of various insects living in relation to it. A bionomical study of this association has been attempted, and some of the parasites have been found occasionally to exercise appreciable control over this caterpillar. In so far as pest plants are concerned, the cochineal (*Dactylopius*) has brought about a remarkable and spectacular result in the eradication of prickly pear.

In dealing with the organization of entomological work, Dr. Ayyar rightly stressed the importance of taxonomy and aptly remarked that discrimination between species is the starting-point of the majority of Indian biological problems. Other important aspects emphasized by him are the need for studies of ecology and of bioclimatics. He remarked that while pure science is often immensely practical and applied science is often very pure, between the two there is really no dividing line, both being necessary for the intellectual and material needs of man. In conclusion, he pleaded for the giving of greater encouragement in scientific institutions and universities to applied science, which is necessary to meet the many material needs of India.

Physiological Research in India

In his presidential address to the Section of Physiology, Prof. N. M. Basu made a plea for the establishment of physiological teaching and research in India, by the provision of better facilities for the holders of teaching posts, and the modification of existing degree courses to encourage the development of the student along the right lines. In spite of the many obstacles, much fruitful work has been carried out in India in recent times. The normal blood picture of the Indian has been established in many districts, and an extension of such work to other areas would be of the greatest value to the practitioner of medicine, as would an extension of the work on the standards of vital capacity and their relation to surface area and height.

Much time has been devoted to nutritional surveys and the investigation of the diets of various areas, and of the effect of supplementing those diets which were found to be deficient. Dietary surveys made in South Indian villages showed that not only are deficiency diseases common, but also the actual calorie intake is lower than the minimum. Addition of very small amounts of milk to such diets is very beneficial, chiefly through the calcium content of the supplement. The diet of middle-class Bengalee families has been found to be deficient in animal fat, animal protein and in calcium.

A considerable amount of work has been devoted to analyses of the composition of various foodstuffs, and to the determination of the biological values of the proteins of common Indian foods. Rice has a high biological value, and, together with pulses, forms a valuable addition to a diet. The vitamins have, naturally, attracted many workers. Vitamin C has been found to exist in large quantities in such native fruits as lichis, mango and guava, and the importance of this vitamin in aiding resistance to infection has been established. The occurrence and stability of carotene and vitamin A in indigenous plants has received attention, and observations of interest have been made on the effect of diet on the absorption of this vitamin from the alimentary tract. An inquiry into the requirements and saturation of various groups in vitamins C and B_1 is now in progress, and promises to yield interesting results.

The preponderance of nutritional research is due to the fact that ample funds are available for it. If they were as well supported, other branches of physiology would advance as rapidly, and the subject would be able to take its full role in the development of biological science and medicine in India.

Dynamic Structure of Human Personality

In his presidential address to the Section of Psychology, H. P. Maiti pointed out that personality in its practical aspects meets us to-day wherever we have to deal with human nature, whether in hospitals, in clinics, in schools and colleges, or in industrial organizations.

There has always been a popular interest in personality, but until recently scientific psychology avoided it, probably because of its complexity. The work of the psychiatrists towards the end of the last century familiarized us with some of the problems of the abnormal personality, and Janet distinguished two main types of personality structure, namely, the 'psychasthenic' and the 'hysteric'. For psychiatric practice this work was fruitful, but it threw little light on the mechanism of personality integration. Nor in spite of the enormous amount of work devoted to their study have personality tests proved of reliable validity, probably because, if personality is a functional whole with interacting parts of which some are dominant over others, then no test or description can be adequate unless it can show the role of each part in the work of the whole. We need a dynamic theory of personality.

The most likely fields of study are (*a*) the clinical and psycho-analytic fields, where variations of function through pathological deviations can be observed, and (*b*) through observation of the normal changes attendant upon development.

The recent modification of the Freudian theory of the neuroses throws some light on a number of difficulties. The distinction of the Id, Ego, and Super-ego, roughly equivalent to the more popular distinction between passion, reason and conscience, shows the effect of the social influences of the early years on the rest of the personality. Genetically, the three are continuous one with the other, and can only be considered separate for functional purposes. The Id is undifferentiated instinct not yet organized under the unity of the Ego; the Ego gradually develops as the Id comes into contact with reality, and the Super-ego grows later out of the developing qualities of the Ego, thus helping the Ego to keep the Id in check.

These factors in their mutual interaction constitute the fundamental scheme of personality in an individual, and form a continuously active system, each part being in dynamic interaction with the other two. In the healthy mind the three structures harmonize, and retain their plasticity throughout life.

Science News a Century Ago

Pentland's Travels in Peru and Bolivia

At a meeting of the Royal Geographical Society on March 25, 1839, extracts were read from a paper by Dr. Bowring "On the Geography of the Country around Cuzco", and an account was given by Joseph Barclay Pentland (1797–1873), H.M. Consul-General in Bolivia, of his travels in Bolivia and Peru during the preceding two years. With the exception of General Miller, it was believed Dr. Bowring and Pentland were the only persons who had visited Cuzco with a scientific object. During his stay in the city—the ancient capital of the Incas—Pentland made plans of the ancient and modern city, and examined the remains of Peruvian architecture. In his paper, he dwelt upon the extraordinary style of cyclopean construction of the ancient Peruvians, which was no less remarkable for the care shown and the remarkable size of the stones, some of which exceeded 150 tons in weight. In the course of his journey, he determined by astronomical observation the position of nearly forty places and he determined their height by barometric measurements. He also referred to a canal cut across a pass of the Western Cordillera into the valley of the Tacna. This was planned by an Englishman named Scott and undertaken chiefly by British merchants. At one point it was 14,652 ft. above sea-level.

A Sawing Machine for Iron Rails

On March 26, 1839, Joseph Glynn, F.R.S. (1799–1863), described to the Institution of Civil Engineers a "Sawing Machine for Cutting off Railway Bars", which had been erected at the Butterley Iron Works, Derbyshire, for cutting rails for the Midland Counties Railway. The machine had two circular saws each of them being 3 ft. in diameter and ⅛ in. thick. They were mounted in headstocks which could be moved at right angles to the rails. They revolved at 1000 revolutions per minute between two disks of cast-iron faced with copper, and dipped into water. The rails were sawn while hot, it taking 12 seconds to saw through the ends of a 78 lb. rail.

Audouin's Advice to a Naturalist

A French naval officer, M. Lefebre, about to travel in countries bordering the Red Sea, solicited instructions as to what objects he should study. Among those he appealed to was the French entomologist Jean Victor Audouin (1797–1841). In the *Athenæum* of March 30, 1839, appeared extracts from Audouin's remarks. "The Gulf of Suez", the article said, "is extremely rich in mollusca, zoophytes, crustaceæ and annelidæ and it is very desirous that the fugitive colours of the Doris, Bursatella, Orchidia, and Tritonia, etc., should be delineated. The animals of several of the shells, also found in the Red Sea, are hitherto unknown; for instance the Anatola, and the same may be said of the zoophytes, concerning which it would be highly important to possess the particulars of form as well as colour, both of which alter so quickly; those of the polypi with flexible stems would be particularly interesting. . . . It is supposed that many new spiders may be found in Abyssinia, and the genus Lycosa, to which the Tarantula belongs, should be especially examined. It is, however, chiefly the class of insects which may be enriched by a journey to Abyssinia."

Societies and Academies

Paris

Academy of Sciences (*C.R.*, **208**, 545–608, Feb. 20, 1939).

H. Colin and Mlle. M.-M. Chollet: Formation of inulin in annual plants. Conditions for formation of inulin are more easily realized in the Campanulaceæ than in the Compositæ.

G. Malécot: Correlations between related individuals, in the hypothesis of homogamy.

V. A. Kostitzin: Compatibility of stable singular points of differential equations.

H. Cartan and S. Mandelbrojt: Solutions of Carleman's problem for a finite interval.

D. Belorizky: Imaginary triple collisions in the plane problem of three bodies.

R. Jamin: Theorem relating to the isentropic flow of perfect gases.

J. Bethenod: Determination of the range in which an alternating current arc functions.

F. Carbenay: Propagation of high-frequency oscillations on networks for the transport of electrical energy.

T. Kofman: Action of visible and ultra-violet light on periodic reactions.

G. Reboul and E. Thibaud: Emission of ionizing radiations by salts of ordinary metals.

J. Solomon: Splitting of radioactive nuclei by neutrons. It is suggested that the action is analogous to 'predissociation' of molecules.

H. von Halban, jun., L. Kowarski and M. Magat: Intensity of the neutrons in cosmic radiation. Radio-element $^{80}_{35}$Br was produced by cosmic ray neutrons, the intensity of which was much greater at a height of 9,500 metres in an aeroplane than on the ground in Paris.

Mme. T. Guilmart: Absorption in the ultra-violet of oximes in the solid state. The bodies exist in two forms with different spectra.

Y. Doucet: Principles of cryoscopy and the construction of a cryoscopic apparatus.

C. Duval and G. Mazars: Micro-estimation of halogen ions; acid-alkali test.

G. Wétroff: Reaction with chlorine of some derivatives of the phosphonitrile radical.

Mlle. M. Murgier: Preparation of soluble molybdic acid.

Mme. Z. Soubarew-Chatelain: Constitution of molybdic acid in dilute aqueous solution.

R. Paul: Opening of hydrofuranic and hydropyranic cycles by acetic anhydride.

W. S. Reich: A new series of esters of the oses, the azoyl-esters.

J. Lugeon: Instantaneous determination, without calculation, of any altitude of a *radio-sonde*.

P. Gavaudan, Mme. N. Gavaudan and J.-F. Durand: Effect of some hydrocarbons and their derivatives on mitosis and on cytodieresis.

A. Tournade and G. Chardon: Mechanism of post-depressive hypertension observed after temporary insufflation of the lungs.

G. Ungar and J.-L. Parrot: Influence of bleeding on the power of the plasma to destroy histamin.

H. Muntz: Fundamental laws of hæmodynamics.

Mlle. V. Deutsch: Sedimentation constant and molecular weight of syphilitic reagin.

S. Metalnikov, A. Yakimach and O. Yadoff: Action of radioactive radiations on microbes.

Dublin

Royal Irish Academy, Feb. 27.

J. M. O'CONNOR: The significance of monomolecular layers of fatty acids in the control of animal oxidation. The influence of temperature from 0° C. upwards on the oxygen consumption of the frog was examined. It is found to show sharp increases between 6° and 14° and between 21° and 30° and at 15°. These changes correspond in position and in extent to the expansion of a monomolecular layer of myristic and palmitic acid in the proportions in which they occur in the frog, and to the melting of palmitic acid.

A. AUSTIN MILLER: River development in South Ireland. The rivers of South Ireland originated as south-flowing consequent streams on a plane above the summits of the present mountains. Later, the rivers have, by repeated captures, extended along the east-west synclines of soft carboniferous rocks until many of them flow in this direction from source almost to mouth, turning south only in the last few miles of tidal estuary. For some time the sea-level stood 800 ft. above that of to-day and cut a broad beach, backed by a line of cliffs, at that height on the southern slopes of the Knockmealdowns and other mountain groups. The sea-level declined by stages to 400 ft., then to 200 ft., then to the level of the pre-glacial raised beach a few feet above Ordnance datum, then to about 100 ft. below present sea-level, returning only quite recently to the present position, drowning the estuaries.

Vienna

Academy of Sciences, January 12.

W. J. MÜLLER, E. LÖW and F. STEIGER: Difference in the rate of corrosion of pure and commercial aluminium in alkaline solutions. The E.M.F. of the local voltaic couples causing the corrosion is the same for both kinds of aluminium; the higher velocity of corrosion of commercial aluminium is due to the lower resistance of the surface film, brought about probably by the inclusion of metallic impurities.

J. LINDNER and B. ZAUNBAUER: Synthesis of quinoline by tetralylamines. 7,8-tetramethylenequinoline.

J. LINDNER, F. SCHMITT and B. ZAUNBAUER: Hydrindene derivatives (2). Simple substitution products.

A. SKRABAL: Continuity of the kinetics of bleaching solution. The various kinetics of bleaching solution are all derived from a single law involving two velocity coefficients.

J. KISSER: Frequency of abnormalities of the leaves of *Juglans regia* due to a late frost.

January 19.

M. STARK: Stages in the development of crystalline schists of the Radstädter chalk beds in the Arltal and Gasteintal.

M. TOPERCZER: Theory of earthquake disturbances. The motion of the ground is assumed to be of the form $x = At^n e^{-at} \sin \omega t$.

O. PAULSEN: Studies of the Raman effect (97). Poly-substituted benzols.

J. BRUNNER: New find of Hipparion fauna at Veles in Macedonia.

A. ERDELYI: Series involving products of Laguerre polynomials.

Washington, D.C.

National Academy of Sciences (*Proc.*, 25, 1–54, Jan. 15, 1939).

W. J. ROBBINS and MARY B. SCHMIDT: Vitamin B_6, a growth substance for excised tomato roots. Slow growth has been maintained over a period of more than two years in a solution of mineral salts, pure cane sugar and thiamin. Growth is improved by substituting a light brown sugar for the pure cane sugar, due apparently to presence of vitamin B_6. Probably the roots synthesize sufficient vitamin B_6 for slow growth in solutions containing thiamin.

W. J. V. OSTERHOUT and S. E. HILL: Chemical restoration in *Nitella* (3). Effects of inorganic salts. Irritability disappeared after two to six days in distilled water but can be restored by 0·01 m. sodium chloride or sulphate in five minutes. This is considerably longer than is required with organic salts, suggesting a different mechanism.

E. DERSHEM: Photomicrographs of thin bone sections by the use of fluorescent X-radiation. A radiator containing an element the K emission lines of which are a little shorter in wave-length than the K absorption wave-length of the principal element of the specimen is used. This radiator (scandium oxide for photomicrographs of bone) is irradiated with an ordinary X-ray tube, and emits radiation heavily absorbed by the specimen. The 'camera' must be evacuated.

G. D. SNELL: Induction by irradiation with neutrons of hereditary changes in mice. Both X-rays and neutrons produce translocations and sterile F_1 males, but both fail to produce detectable numbers of recessive mutations.

D. BODENSTEIN: Imaginal differentiation inaugurated by oxygen in *Drosophila* pupæ. The presence of oxygen, rather than a differentiation hormone in the anterior part, seems to be necessary for differentiation of the abdominal ectoderm.

H. C. SHERMAN, H. L. CAMPBELL and C. S. LANFORD: Experiments on the relation of nutrition to the composition of the body and the length of life. Contrary to the classical view that the chemical composition of an organism is rigidly specific, it is found that rate of calcification in the normally developing body can be varied by adjusting calcium intake within the normal range, without departure from full health. The higher intake seems to be permanently advantageous. High intake of vitamin A has improved length of life and vitality of offspring.

E. B. WILSON and JANE WORCESTER: Resolution of tests into two general factors.

W. R. MILES: Steady polarity potential of the human eye. Electrodes are placed on the skin near the eyes and the body potential balanced out. The potential of the eyeball is closely proportional to the sine of the angle of rotation of the eye.

O. STRUVE: Physical state of the interstellar gas clouds. A theoretical discussion leads to the view that there is a high abundance of hydrogen atoms in interstellar gas; roughly, hydrogen atoms to calcium atoms are as 10^6 to 1.

G. A. MILLER: Groups of degree n in which the largest degree of a substitution is a minimum.

E. T. BELL: Euler's concordant forms.

S. LEFSCHETZ: Mapping of abstract spaces on polytopes.

J. W. TUKEY: Intrinsic metric of a polytope.

J. W. ALEXANDER: Concept of a tological space.

Forthcoming Events

CHEMICAL SOCIETY, March 29–31.—Anniversary Meetings. March 29, at 5.—Sir Henry Tizard, F.R.S. Rutherford Memorial Lecture to be delivered at the Royal Institution.

March 30, at 2.30.—Annual General Meeting. At 4.—Presidential Address.

BRITISH PSYCHOLOGICAL SOCIETY, March 30–April 3.—Extended General Meeting to be held at Reading.

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

SCIENTIFIC OFFICER (physicist) to the Wool Industries Research Association—The Secretary, Torridon, Headingley, Leeds, 6 (April 1).

DEMONSTRATOR IN INORGANIC AND PHYSICAL CHEMISTRY in Bedford College, Regent's Park, N.W.1—The Secretary (April 6).

INSPECTOR OF AVIATION FUELS AND LUBRICANTS in the Aeronautical Inspection Directorate—The Under-Secretary of State, Air Ministry (S.2.d.), Berkeley House, W.1.

LECTURER (WOMAN) IN GEOGRAPHY in the Lincoln Diocesan Training College—The Principal.

Reports and other Publications

(not included in the monthly Books Supplement)

Great Britain and Ireland

The One Hundred and Fifth Annual Report of the Royal Cornwall Polytechnic Society. New Series, Vol. 9, Part 2, 1938. Pp. 124. (Camborne: Camborne Printing and Stationery Co., Ltd.) 5*s*. [212

Physical Society. Reports on Progress in Physics, Vol. 5. General Editor: Allan Ferguson. Pp. v+445. (London: Physical Society.) 20*s*. net. [222

Brompton Hospital Reports: a Collection of Papers recently published from the Hospital. Vol. 7, 1938. Pp. iv+207+39 plates. (London: Brompton Hospital.) 5*s*. [232

Transactions of the Royal Society of Edinburgh. Vol. 59, Part 3, No. 22: The Structure and Function of the Alimentary Canal of some Tectibranch Molluscs, with a Note on Excretion. By Dr. Vera Fretter. Pp. 599–646. 6*s*. Vol. 59, Part 3, No. 23: The Cytology of the Thelytokously Parthenogenetic Saw-Fly *Thrimax macula* Kl. By Prof. A. D. Peacock and Dr. Ann R. Sanderson. Pp. 647–660+4 plates. 3*s*. 6*d*. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) [232

Check-Lists of the Forest Trees and Shrubs of the British Empire. No. 4: Draft of First Descriptive Check-List for Ceylon. Compiled by L. A. J. Abeyesundere and R. A. De Rosayro. Pp. iii+115. (Oxford: Imperial Forestry Institute.) [242

Scientific Proceedings of the Royal Dublin Society. Vol. 22 (N.S.), No. 7: A Study of the Seasonal Development of the Potato Plant in relation to Blight Attack and Spraying. By Paul A. Murphy. Pp. 69–82. (Dublin: Hodges, Figgis and Co.; London: Hodges, Figgis and Co., Ltd.) 1*s*. [272

Committee of the Privy Council for Medical Research. Report of the Medical Research Council for the Year 1937–1938. (Cmd. 5939). Pp. 221. (London: H.M. Stationery Office.) 3*s*. 6*d*. net. [13

Scientific Horticulture (formerly the H.E.A. Year Book). Vol. 7, 1939. (Published by the Horticultural Education Association.) Pp. 212+xxxii+12 plates. (Wye: South-Eastern Agricultural College.) 4*s*. net. [13

Emergency Medical Services. Memorandum No. 2: Emergency Hospital Organisation. Pp. 29. (London: H.M. Stationery Office.) 6*d*. net. [13

The British Broadcasting Corporation. Twelfth Annual Report, 1938. (Cmd. 5951.) Pp. 36. (London: H.M. Stationery Office.) 6*d*. net. [23

Department of Scientific and Industrial Research: Food Investigation. Leaflet No. 8: The Cold Storage and Gas-Storage of Eggs. By Dr. T. Moran. Pp. 9. (London: Department of Scientific and Industrial Research.) Free. [63

Publications of the International Tin Research and Development Council. No. 90: The Electrolytic Polishing of Tin and its Application to Micrographic Examination. By P. A. Jacquet. Pp. 12+12 plates. Free. No. 91: Anodic Films on Tin in Sodium Hydroxide Solutions. By Dr. R. Kerr. Pp. 14. Free. (Greenford: International Tin Research and Development Council.) [63

Department of Scientific and Industrial Research. Methods for the Detection of Toxic Gases in Industry. Leaflet No. 3: Sulphur Dioxide. Pp. iv+6. 2*s*. 6*d*. net. Leaflet No. 4: Benzene Vapour. Pp. iv+9. 3*d*. net. (London: H.M. Stationery Office.) [63

University College of Wales, Aberystwyth: Welsh Plant Breeding Station. The Temporary Ley. (Series H, No. 15, Sessions 1930–1937.) Pp. vi+150. Aberystwyth: Welsh Plant Breeding Station.) 7*s*. 6*d*. [93

Other Countries

Tanganyika Territory: Department of Agriculture. Annual Report, 1937, Part 2. Pp. 48. (Dar es Salaam: Government Printer.) 2*s*. 6*d*. [212

The Hebrew University, Jerusalem: its History and Development. Pp. xi+146. (Jerusalem: Hebrew University.) [212

Cawthron Institute, Nelson, New Zealand. Cawthron Lecture, 1938: Modern Advances in Medicine. By Dr. D. M. Carnalt Jones. Pp. 30. (Nelson: Cawthron Institute.) [222

Imperial College of Tropical Agriculture. Reports of the Governing Body, the Principal's Report and the Accounts for the Year ended August 31, 1938. Pp. 40. (Trinidad and London: Imperial College of Tropical Agriculture.) [222

Transactions of the American Philosophical Society. New Series, Vol. 31, Part 1: The Discovery of Antarctica within the American Sector, as revealed by Maps and Documents. By William Herbert Hobbs. Pp. 71+31 plates. (Philadelphia: American Philosophical Society.) 2.50 dollars. [222

Aparato sexual femenino del *Bufo arenarum*: variaciones cíclicas y mecanismos reguladores de su actividad y estructura. Por la Dr. Inés López Colombo de Allende. Pp. xii+166. (Córdoba: Instituto de fisiología.) [232

Proceedings of the United States National Museum. Vol. 86, No. 3049: New Species of Polychæte Worms of the Genus Euphrosyne, with Notes on *Euphrosyne borealis* Örsted. By Aaron L. Treadwell. Pp. 169–174. (Washington, D.C.: Government Printing Office.) [242

U.S. Department of Agriculture. Technical Bulletin No. 656: Cost of Producing Extracted Honey in California. By R. L. Adams and Frank E. Todd. Pp. 36. (Washington, D.C.: Government Printing Office.) 10 cents. [242

Geological Survey of British Guiana. Bulletin No. 12: 1. Explanatory Note on the Geological Map of the Groete Creek–Lower Cuyuni–Puruni Goldfield, by S. Bracewell; 2. Report on the Kartabu–Oko–Aremu Section of the Cuyuni District, by D. R. Grantham; 3. Report on the Wariri–Aremu–Quartzstone Section of the Cuyuni District, by D. R. Grantham; 4. Report on the Area between Tinamu Fall and the Katuau River, by S. Bracewell. Pp. 49. (Georgetown: Geological Survey.) 24 cents. [242

U.S. Department of the Interior: Office of Education. Monograph No. 19: Agricultural Education Programs. Pp. v+21. 10 cents. Vocational Division Bulletin No. 113 (Vocational Rehabilitation Series No. 12): Administration of Vocational Rehabilitation. Revised edition. Pp. vi+59. 10 cents. (Washington, D.C.: Government Printing Office.) [272

Report on the Zoological Survey of India for the Years 1935 to 1938. Pp. lxxviii+3 plates. (Delhi: Manager of Publications.) 1.14 rupees; 2*s*. 3*d*. [272

Memoirs of the Indian Museum. Vol. 13, Part 1: Cirripedes from the Indian Ocean in the Collection of the Indian Museum, Calcutta. By Dr. Carl Aug. Nilsson-Cantell. Pp. 84+3 plates. (Calcutta: Zoological Survey of India.) 4.4 rupees; 6*s*. 9*d*. [272

Commonwealth of Australia: Bureau of Meteorology, Melbourne. Bulletin No. 24: Weather Conditions affecting Aviation over the Tasman Sea. Part 1: Weather Conditions from Records of Ships' Logs and Land Observations; Part 2: Some Adverse Aviation Weather Conditions on the New South Wales Coast. By H. M. Treloar and B. W. Newman. Pp. xii+34+iv+34 plates. (Melbourne: Government Printer.) [272

Bulletin of the Vanderbilt Marine Museum. Vol. 7: Scientific Results of the World Cruises of the Yachts *Ara*, 1928–1929, and *Alva*, 1931–1932, *Alva* Mediterranean Cruise, 1933, and *Alva* South American Cruise, 1935. Marine Algæ: Chlorophyceæ and Corallinaceæ; Coelenterata: Hydroida, Leptomedusæ, Siphonophora, Scyphomedusæ, Alcyonacea, Pennatulacea, Actinaria and Madreporaria; Annelida Polychæta; Echinodermata: Asteroidea, Crinoidea, Ophiuroides; Echinoidea and Holothuroidea; Crustacea: Anomura, Macrura, Brachyura, Stomatopoda and Cirripedea; Mollusca: Cephalopoda, Amphineura, Gastropoda, Nudibranchiata and Pelecypoda. By Lee Boone. Pp. 373+152 plates. (Huntington, L.I.: Vanderbilt Marine Museum.) [272

Canada: Department of Mines and Resources, Mines and Geology Branch: Bureau of Mines. Improving the Properties of Clays and Shales. By J. G. Phillips. (No. 793.) Pp. iii+39. (Ottawa: King's Printer.) 25 cents. [13

Field Museum of Natural History. Botany Leaflet 23: Carnivorous Plants and "The Man-Eating Tree". By Sophia Prior. Pp. 20+8 plates. (Chicago: Field Museum of Natural History.) 25 cents. [23

Bulletin of the American Museum of Natural History. Vol. 76, Art. 1: The Social Behavior of the Jewel Fish, *Hemichromis bimaculatus* Gill. By G. K. Noble and Brian Curtis. Pp. 46+1 plate. (New York: American Museum of Natural History.) [23

Suomen Geodeettisen Laitoksen Julkaisuja. No. 26: Finnisches Geodätisches Institut, 1918–1938. Pp. 128+15 plates. (Helsinki: Finnischen Geodätischen Instituts.) [23

U.S. Department of the Interior: Office of Education. Vocational Division Bulletin No. 197 (Trade and Industrial Series No. 56): Training for the Police Service. By O. D. Adams. Pp. viii+84. (Washington, D.C.: Government Printing Office.) 15 cents. [63

Catalogues, etc.

Catalogue de livres anciens et modernes, rares ou curieux relatifs à l'Orient. (No. 38.) Pp. 124. (Paris: Libr. Adrien-Maisonneuve.)

Catalogue of New Books on Civil and Electrical Engineering (including Wireless). Pp. 28. Catalogue of New Books on Physics, Mathematics and Astronomy. Pp. 32. (London: H. K. Lewis and Co., Ltd.)

The Engineer Directory and Buyers Guide, 1939. Pp. 260. (London: *The Engineer*.)